

DISTRIBUTED DATA PROCESSING

VOLUME 1

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DISTRIBUTED DATA PROCESSING

Prepared For:

INTERNATIONAL BUSINESS MACHINES CORPORATION

GENERAL SYSTEMS DIVISION

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I INTRODUCTION

A. PURPOSE

- It is the intent of this study to:
 - Determine the extent to which Distributed Data Processing (DDP) as a concept has been received and actually implemented in 12 specific industry segments within the United States. These industry segments were further broken down into various enterprise sizes.
 - Estimate and forecast the potential and actual shipments of computer systems and those to be employed in a DDP architecture for all of the above industry and enterprise sizes for the time periods 1977, 1980, 1983 and 1986.
- It was further required to evaluate by specific industry sector:
 - DDP user requirements.
 - Business and economic factors that could impact DDP acceptance.
 - Factors motivating or inhibiting potential DDP users.
 - How DDP is economically justified.

- Any unique competitive issues.
- The relationship of DDP to the enterprise structure and organization.

B. RESEARCH AND METHODOLOGY

- The research for this program was heavily dependent upon telephone contacts and screening resulting in a number of detailed host and remote on-site interviews with DDP qualified personnel.
- An initial questionnaire was drafted by INPUT and refined in meetings with IBM.
- A series of sample interviews were performed, results examined by both IBM and INPUT, with final revisions being made to the questionnaire.
- Adjustments in enterprise size emphasis were made during the course of the study as a function of difficulties encountered in certain industry segments with regard to finding qualified DDP respondents.
- A total of 92 enterprises were visited by senior staff for purposes of performing detailed host interviews, which in turn resulted in 21 remote site interviews. Interview times ranged from 1-4 hours depending on the relative experience and sophistication of the respondent.
- INPUT also completed 138 telephone interviews which were conducted with non-DDP respondents.
- Six on-site interviews were conducted with non-DDP respondents for purposes of gathering more detailed information in the distribution industries.

- Respondents that were contacted and interviewed were randomly selected from information provided by IBM as well as from random enterprise selections made by INPUT. Respondents' names and companies were not disclosed to IBM nor was IBM identified to respondents as the sponsor of this work.
- Information resulting from these interviews was coded and tabulated by computer with the resultant data (presented in Volume II) analyzed by the senior staff conducting the above interviews.
- INPUT does not regard the total number of interviews conducted as statistically valid. Furthermore, these interviews yielded limited quantitative information.
- Accordingly, other market related information developed by INPUT, or available in the public domain, was used in constructing DDP market estimates and forecasts.
- The methodology used and forecast results obtained are to be found in Section IV of this volume.

II EXECUTIVE SUMMARY

A. MAJOR CONCLUSIONS

I. DDP OUTLOOK AND GROSS MARKET PROJECTIONS

- INPUT believes that based upon the information gathered during the course of this study the extent to which DDP systems have been implemented is relatively nominal with few exceptions.
- However, the concept appears to be gaining in acceptance at varying rates within different industry sectors. A selected number of pilot installations were uncovered during the study research that are planned on becoming operational over the next 12 months.
- Exhibit II-1 presents INPUT's ranking of the extent to which the DDP concept has been accepted and systems actually implemented by industry sector in 1977 and how this ranking will change through 1986.
- It is important to note that this is a subjective chart which represents INPUT's view based upon the research performed.
- Colleges, banking, and the process and manufacturing industries are believed to be in the vanguard of acceptance and implementation of the DDP concept. The distribution and services groups appear to be laggards.

EXHIBIT II-1

RANK ORDERING OF
DDP SENSITIVITY BY INDUSTRY
(1977-1986)

INDUSTRY	1977	1986
WHOLESALE	12	12
RETAIL	7	5
PROCESS (w/o OIL)	5	3
PETROLEUM	4	2
AERO/AUTO	6	7
DISCRETE MANUFACTURING	3	4
BANKING	2	1
SCHOOL DISTRICTS	8	8
HOSPITALS	9	10
CITY/COUNTY	10	9
MOTOR FREIGHT	11	11
COLLEGES	1	6

- These ratings are not expected to materially change (all things being equal) through the forecast period with several notable exceptions.
- Colleges have traditionally been quite aggressive in experimenting with and adopting advanced DP techniques. INPUT believes that is currently the situation with DDP. However, INPUT expects that as the concept becomes more widely accepted, in conjunction with the funding limitations colleges have always faced, other industry sectors will overhaul the college group.
- Contingent upon developments in POS and EFTS and certain regulatory actions, the rate of retail acceptance of DDP could be significant through the forecast period.
- INPUT further believes that the current breakthrough for the acceptance and implementation of the DDP concept is at the 1,000-2,000 employee level and is being pursued by larger sized enterprises.
- DDP is not well understood, much less being implemented, among small businesses.
- DDP growth will most dramatically impact Class I and Class IV systems over the 1977-1986 period. (See Exhibit II-2.) Unit forecasts for 1977 system shipments to a DDP environment are estimated to be less than 10% of Class I, II, and III all vendor unit shipments. However, INPUT believes that about 25% of 1977 Class IV unit shipments entered a DDP environment.
- INPUT estimates the 1977 market for Class I-IV systems that were shipped into the defined DDP market segments was \$1.70 billion and projects this shipments market to grow to approximately \$19.0 billion by 1986.
- This represents approximately 8,000 total units in 1977 and 140,000-150,000 total units in 1986.

EXHIBIT II-2

TOTAL U.S. SYSTEM SHIPMENTS AND BREAKOUT OF

THOSE SYSTEMS DEDICATED TO DDP

(K UNITS)

SYSTEM CLASS	YEAR														
	1977				1980				1983				1986		
	SHIP-MENTMENTS (SYS-TEMS)	DDP ENVIRONMENT		SHIP-MENTMENTS (SYS-TEMS)	DDP ENVIRONMENT		SHIP-MENTMENTS (SYS-TEMS)	DDP ENVIRONMENT		SHIP-MENTMENTS (SYS-TEMS)	DDP ENVIRONMENT		SHIP-MENTMENTS (SYS-TEMS)	DDP ENVIRONMENT	
		UNITS	%		UNITS	%		UNITS	%		UNITS	%		UNITS	%
I	70	< 7	<10	150	15-30	10-20	270	40-70	15-25	500	100-175	20-35			
II	3	<0.3	<10	4.0	<0.4	<10	4-5	<0.5	<10	4-5	<0.5	<10			
III	2	<0.2	<10	2.5	<0.3	<10	2.7	<0.3	<10	3	<0.3	<10			
IV	2.1	0.4-0.6	20-30	3.2	1-1.5	35-50	4.8	2-3	50-60	7.5	5-6	70-80			

- Although unit shipments of Class I systems entering DDP applications areas represent over 85% of the total units for 1977 and 1986, it is important to note that Class IV system DDP shipments account for over 70% of the system value for these same years.
- The large Class IV systems included in the DDP shipment category are performing and will continue to perform a larger percentage of non-DDP oriented tasks during the course of operations. On the other hand, small Class I systems shipped into DDP applications can be tailored for such tasks and are very likely to be totally dedicated toward DDP.

2. PERCEIVED DRIVING/INHIBITING FORCES

- The primary motivation for adopting DDP was a desire to move data management and control to the data source and principal user. In so doing, respondents expected to improve the timeliness of information reporting, increase accuracy and generally improve the quality of user service.
- Private comments by qualified DDP respondents across all industry sectors cited mainframe capacity limitations accompanied by a desire to "break the mainframe upgrade cycle" as a major driving force.
- There appears to be a widely held belief that DDP offers a more cost effective approach to data processing and that respondents indeed conducted some form of favorable cost/benefit analysis to substantiate this belief within their respective enterprises.
- However, INPUT concludes that detailed concrete analyses supporting this hypothesis is currently lacking and there is very limited actual "before and after" cost comparison data among DDP respondents.
- User complaints, competitive pressures and a desire by management to maintain or accelerate rates of growth are factors which seem to be pushing the evolution of the DDP concept.

- IBM's perceived entry into the DDP market with the Series/1 and System 34 products is regarded by respondents as evidence that the company is increasingly sanctioning and supporting the concept.
- INPUT believes that one of the key inhibiting factors to DDP is a relative lack of insight and knowledge of most respondents regarding communications issues.
- More experienced DDP respondents were extremely sensitive to communications costs and placed great emphasis on this variable in their deliberations and planning. Complaints were varied about tariffs being too high and too many lines being required for DDP implementation.
- Sixty percent of all respondents believed that a continuation in the lack of DDP standardization (and implicitly a lack of hardware/software compatibility) would impair the growth of the concept and cited a lack:
 - Of standardization in communications networks and an inability in those proposed network solutions; e.g., SNA and DECNET, to communicate with one another.
 - In system software packages that can function in a DDP environment with no proven DBMS.
- Another perceived inhibiting factor is IBM's lack of presence in the market with a line of products more fully supportive of the DDP concept:
 - The 3790 received generally unfavorable reviews.
 - DPD was not perceived as being equipped or inclined to do the job.

3. VENDOR RELATED ISSUES

- The two most important and dominant factors articulated by both host and remote DDP respondents in vendor selection were the:

- Reliability of the hardware and software and,
 - The vendor's ability to provide maintenance support.
- Software and hardware compatibility in conjunction with the diversity of software languages offered by vendors ranked relatively high.
 - Cost/performance features as well as the ease of software use were frequently mentioned but are judged to be somewhat secondary in importance.
 - It is INPUT's conclusion that GSD-2 class of enterprises are desirous of having networking with a high degree of compatibility; i.e., 3270 emulation and SDLC support.
 - GSD-1 class of enterprises that elect to employ a DDP architecture would like a turnkey package.
 - Of the total host and remote respondents polled, both DEC and IBM were regarded as the most influential in promoting the DDP concept.
 - Over 40% of the respondents singled out IBM as the company most inhibiting to the progress of DDP. NCR was a far distant second with less than 10% of the responses.
 - Within IBM, respondents regarded DPD as the DDP "inhibitor" and GSD as the "supporter" but only as a result of recent product introductions.
 - INPUT was somewhat surprised by the general inability of most respondents to clearly articulate reasons for the above conclusions.

4. CENTRALIZED VS. DECENTRALIZED CONTROL

- Over 80% of all host and remote respondents indicated that their current DDP systems development and equipment procurement were centrally controlled.

- Even decentralized companies with relatively autonomous operations maintain central control through a divisional or group DP operation.
- Centralized procurement of hardware proceeds across divisional lines.
- There appears to be a need to regain control of data at a central site enabling management to better use this information (by means of data bases and files) in running the enterprise.
- A distinction must be made between operating and strategic data in that the corporate entity generally does not want or use detailed operating information.
- As data base management systems software techniques improve and the user gains experience, INPUT believes that the propensity to decentralize will increase. However, there will continue to be strong centralized control of a distributed network.
- Some limited evidence supporting this thesis was encountered during this study as 50% of respondents thought that future systems development and equipment procurement would be centrally controlled (down from 80% currently).
- Large businesses are clearly more effective in their delegation of authority and consequently represent the best prospects for DDP.
- Small businesses tend to be family owned and managed and are somewhat autocratic with a strong inclination toward centralization. Nonetheless, if the president got sold on the idea (DDP) it was obviously going to be implemented.
- End users liked the idea of data independence and responsive reporting of operational information; i.e., less interaction with and dependence upon the host. However, because of their almost complete lack of DP sophistication and the high cost of labor; i.e., programmers, the remote system for all intents and purposes must be transparent to this user.

- Approximately two-thirds of all respondents reported satisfaction ranging from good to outstanding with their DDP systems. Less than 5% characterized their experience as poor.

5. DDP WITHIN LARGE AND SMALL COMPANIES

- The DDP concept is not well understood in small single unit (SUE) or multiple unit enterprises (MUE) and will require greater educational efforts and more demonstrated operating experience in both large and small companies.
- Approximately two-thirds of the MUE interviews were conducted in the larger GSD-2 enterprise range, and in INPUT's judgement, fairly represents where the current DDP market in the United States is concentrated.
- In those isolated instances where INPUT was able to find even marginally qualified MUE (and to a significantly lesser extent SUE) respondents, such systems were of a rudimentary nature and were not actually implemented as yet.
- It is INPUT's distinct impression that the basic DP function in GSD-1 enterprises is less well accepted than in larger enterprises and the degree of experience and sophistication at the lower levels lags accordingly. This leads to the conclusion that the DDP concept is arriving on the scene before there exists greater understanding and acceptance of the role of data processing within smaller entities.
- The breakpoint for current DDP implementation seems to be at the 1,000-2,000 employee range per enterprise for those industries employing this unit of measure.
- Limited visibility existed within all interviewed enterprises with DDP respondents almost completely unable to project procurement plans beyond the 1980 timeframe.

- The most important criteria consistently mentioned (45% of all DDP respondents) as determining the success or failure of DDP across all industry sectors was the need for detailed planning by the user in implementing a DDP system.
- The single greatest reported motivator for adopting a DDP system was to move data management and control to the data source and principal user.
- Although off-loading the mainframe was only specifically singled out by 5% of all respondents as a DDP benefit, its importance is significantly higher than this statistic would suggest.
- Private comments in most industry sectors, and particularly in banking, cited mainframe capacity limitations as a major DDP driving force.
- The most significant positive DDP factor identified by 50% of all respondents was the cost performance benefits experienced or anticipated.
- The most concern or negative factor mentioned by respondents regarding DDP was the loss of control which was cited by almost one-third of the respondents.
- Over 135 telephone interviews were conducted with non-DDP users with heavy emphasis in the wholesale, retail and discrete manufacturing areas. This resulted from the singular lack of success INPUT experienced in efforts to find qualified DDP respondents in the GSD-I range of enterprises within these market sectors.
- The most consistently stated reason for not implementing a DDP system by non-DDP respondents was a belief that the enterprise was too small. Private comments also cited concerns over the cost to implement DDP or the issue not enjoying a high priority.
- In defining DDP strengths, non-DDP respondents cited many of the same factors as did DDP respondents including timeliness of information reporting and moving control and flexibility of data handling to the source as well as unloading the mainframe.

- Loss of central control, as in the DDP respondents sample, was most frequently highlighted as a DDP weakness.
- It is worthy to note that only 13% of these non-DDP respondents believed that vendor supplied applications software would be a sufficient inducement to go to a DDP system. This seems to be consistent with the relatively low level of importance assigned to this issue by DDP respondents.
- Limited visibility existed as to when DDP would next be evaluated within the non-DDP enterprise much less as to which key applications might be considered for implementation.

6. KEY ARCHITECTURAL AND APPLICATIONS ISSUES

- INPUT believes that DDP is currently very early in its evolutionary cycle with most existing or planned installations functioning in a star configuration.
- Both the banking and discrete manufacturing industries exhibited a high incidence of hierarchical networks due to their more advanced state of DDP development.
- Limited evidence existed of ring structures (with or without hosts) although it is INPUT's belief that future applications for such ring structures will evolve in selected market areas.
- There appears to be a lack of both user sophistication and vendor product offerings related to network architecture. DP managers need assistance in the communications area.
- Applications currently being performed by respondents placed heavy emphasis on traditional business accounting functions with close correlation between host and remote responses.
- Approximately 50% of the respondents identified order entry, organizational recordkeeping, invoicing and inventory control as key applications to be performed using DDP communications.

- INPUT believes that DDP will not of itself spawn significant additional new applications in the short term but rather will be used to provide improvements of traditional DP methods to perform these same applications.

7. MAJOR ISSUES

a. Data Bases

- Although 55% of DDP host respondents stated their intention to distribute data bases they appeared to be discussing simple file manipulation and distribution rather than the use of an integrated data base management software (DBMS) system.
- This appears to be a very confusing issue with small users not having any apparent understanding of these issues and large users lacking in optimism that a proven DBMS package will be available soon.
- Sophisticated users are extremely sensitive to DBMS because of the significant impact they believe this will have on their communications costs.
- The size of nodal data bases varied widely from below one megabyte to in excess of 100 megabytes. All data bases are completely redundant with little concern over this potential problem area.

b. Communications

- The overriding concern of qualified DDP respondents regarding communications was consistently the cost issue which INPUT regards as key in the evolution and adoption of DDP.
- Approximately 70% of all DDP respondents believed that advances in communications would favor, in varying degrees, the acceptance of DDP.

- Respondents expressed significant concern over their dependence upon the telephone company and were further disturbed over network reliability and compatibility problems within the telephone system.
- The average user appears to be relatively poorly informed regarding communications and looks for strong vendor support. The sophisticated user is concerned about SNA and determining who is going to support the concept.
- The major transmission mode used by respondents currently is batch with interactive methods expected to make moderate inroads over the next 3-4 years.

c. Software

- Respondents overwhelmingly believed that an increase in hardware/software compatibility would have an extremely favorable impact upon DDP development.
- Software compatibility and the diversity of software languages that were available to the market were ranked very highly as vendor selection criteria.
- As noted earlier, the lack of a DBMS package is of major concern to the more sophisticated users.
- The availability of vendor supplied applications software appears to have little weight in vendor selection or as an inducement to go to DDP.
- COBOL is far and away the dominant software language in current use far overshadowing BASIC, RPG or FORTRAN.

d. Security

- The issue of security was generally greeted with disinterest by most respondents with the possible exception of the banking industry and very large multinational corporations.

- Encryption of either communications or data bases were widely viewed as unimportant requirements.
- Current and future security concerns are principally focused on positive user identification and the development of audit trails.

e. DDP Justification

- By far the most frequently employed justification procedure reported by respondents (in two-thirds of the cases) was related to the performance of some form of cost/benefit analysis.
- As part of this analysis a variety of alternate DP methods were evaluated for DDP replacement with several subsequently eliminated upon implementing a DDP system. These included in descending order of frequency of occurrence:
 - Batch processing.
 - Manual methods.
 - On-line data entry.
 - Centralized processing.
 - Key punch.
- It appeared to INPUT that formalized profit and loss impact, payback, or ROI analyses were probably conducted only in the largest types of GSD-2 enterprises. Smaller companies placed more emphasis on recognition of operating bottlenecks and the need to take positive action to relieve these problems. It was frequently intuitively assumed that positive cost benefits would be derived as a result of employing a DDP approach.

- With the exception of isolated comments regarding "payback in two months" and "...DDP reduced our annual inventory levels by \$30 million from a pre-DDP base of \$100 million," INPUT believes that little detailed analyses currently exist to support the cost/benefit thesis associated with DDP.

B. RECOMMENDATIONS

- INPUT recommends that the following be factored into GSD's product and market planning:
 - User respondents are sensitive about potentially losing EDP control through the implementation of DDP.
 - Close to 80% of present DDP installations are of a "star" and hierarchical configuration.
 - There is a massive selling and training job yet required in order to fully acquaint the user with DDP.
 - DDP is a means for selling more minicomputer driven systems, and is not an end in itself.
- Recognize that the larger (GSD-2) enterprises are the prime targets in the short term for DDP implementation.
- Emphasize marketing efforts towards those industries having the greater propensity towards incorporating DDP; i.e., banking, process and discrete manufacturing.
- Target the DDP sales effort towards the corporate DP Manager; he is the required corporate "internal advocate."

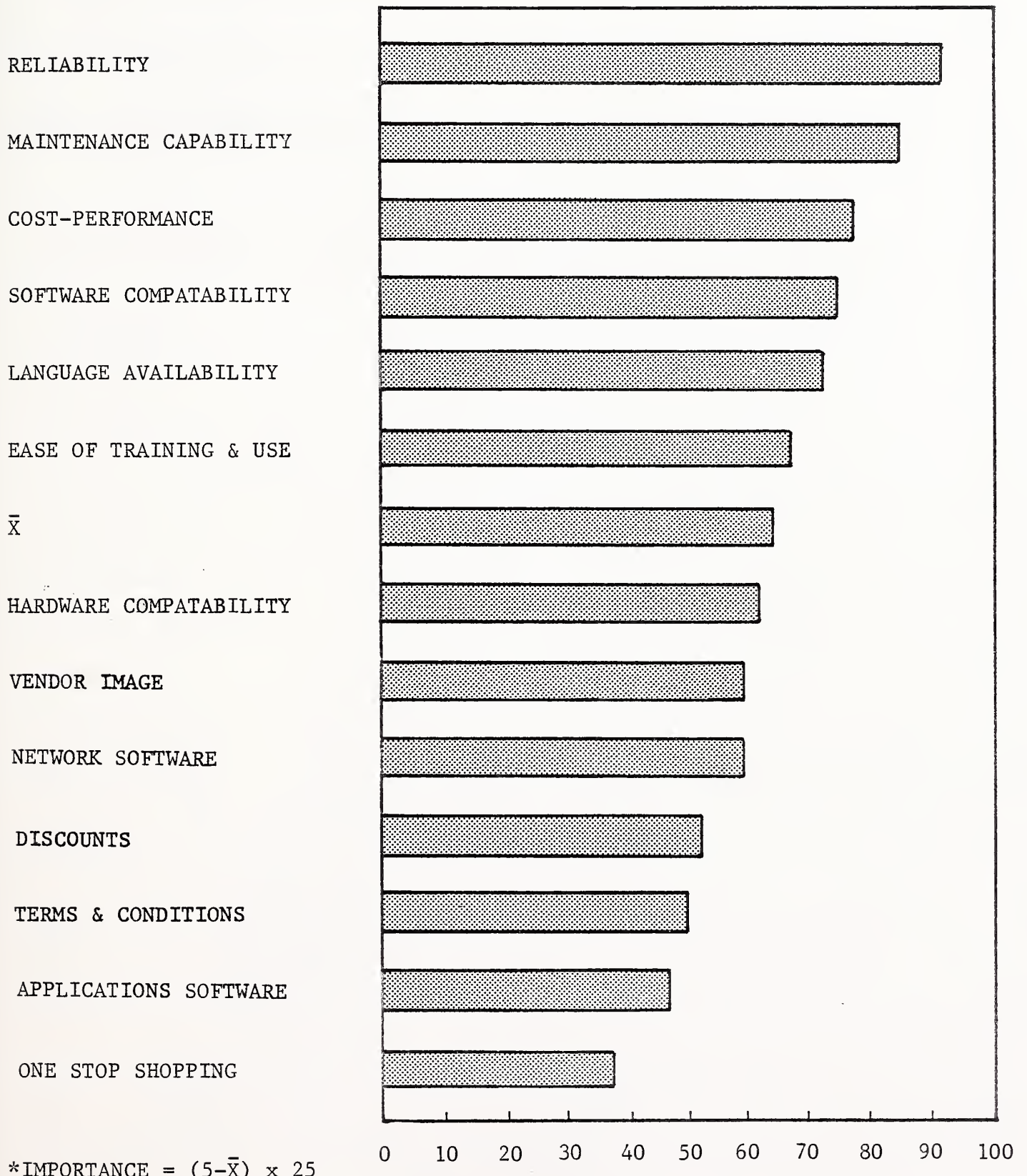
- Develop a coordinated IBM corporate posture embracing DDP and GSD in order to eliminate the prospective DDP user's confusion.
- Investigate the feasibility of marketing "ring" DDP installations within the functional department of an enterprise, for example:
 - Warehouse control.
 - Factory data collection.
 - Intra-corporate communications.
 - Automated process manufacturing.

Such installations often are controlled by the functional department's budget rather than an EDP budget. Furthermore, it can be installed on a unit by unit basis, and need not be referred to as a "computer system."

- Reflect the following in the formulation of a marketing strategy (see Exhibit II-3):
 - Product reliability and maintenance is of prime user concern.
 - Closely following in importance are factors involving compatibility, conversion and ease of training or use.
 - Of little or no concern are discounts, special terms and conditions, applications software and "one stop shopping."
 - Avoid emphasis of multiple applications for remote sites but consider the sale of each standalone product as going into a potential DDP node.
- Consider marketing a complete product line to the GSD-2 corporate EDP manager including all of the following:

EXHIBIT II-3

RELATIVE IMPORTANCE* - VENDOR SELECTION CRITERIA



- Class I systems.
- Remote site terminals or system controller; e.g., 3790.
- A communications network and systems engineering design capability.
- Communications controller interfacing with host systems; e.g., 370X.

To be excluded from the above is the largest class of mainframes; i.e., the 30XX and its successors.

- Emphasize the development of DBMS to be used by non-technical personnel towards furthering the concept of distributing data bases.

III ANALYSIS OF DDP SYSTEM USER/NON-USER ATTITUDES

III ANALYSIS OF DDP SYSTEM USER/NON-USER ATTITUDES

A. APPROACH

- The analysis and conclusions that follow were derived primarily from the data presented in the tables to be found in Volume II of this report.
- The data that appears in these tables were, in turn, derived from the questionnaire which was jointly constructed by INPUT and the client.
- Many of these questions were of an open ended nature and yielded highly qualitative types of responses.
- In order to facilitate the process of coding these replies into a form suitable for computer processing and data reduction, a number of subjective decisions were made by INPUT analysts and programmers.
- For purposes of minimizing analyst/programmer biases in the coding process and properly preserving the context of these interviews, the resultant data was analyzed (and conclusions drawn) with frequent reference to the original source documents.

B. GENERAL MARKET CHARACTERISTICS AND DRIVING FORCES
(STATISTICAL ANALYSIS)

I. USER SOPHISTICATION AND DDP EXPERIENCE (MUE/SUE)

- Over 95% of the qualified DDP host interviews were conducted in multiple unit enterprises (MUE) and reflect the difficulty INPUT encountered in finding DDP qualified single unit enterprises (SUE) during the study.
- Approximately two-thirds of the MUE interviews were conducted in the larger GSD-2 enterprise range, and in INPUT's judgement, fairly represents where the current DDP market in the United States is concentrated.
- A greater degree of difficulty was encountered in finding DDP qualified respondents in the GSD-1 enterprise range with this difficulty being inversely related to the size of the enterprise; i.e., the smaller the company the greater the likelihood it did not have (or was not planning) a DDP system.
- As a further measure of the difficulties encountered in the GSD-1 range, the total number of telephone attempts at least doubled in order to be able to find qualified DDP respondents.
- The breakpoint for current DDP implementation seems to be at the 1,000-2,000 employee range for those industries employing this unit of measure.
- In those isolated instances where INPUT was able to find even marginally qualified MUE/DDP respondents, such systems were of a rudimentary nature and were not actually implemented as yet. These same observations would extend to those few SUE contacts that were made.
- EDP experience levels among all qualified DDP respondents were relatively high with one-third of the respondents reporting 15-20 years of experience and with 75% reporting more than 9 years.

- However, close to 40% of these respondents reported no prior or current DDP experience; i.e., a number of the proposed DDP systems had actually not been implemented as yet.
- INPUT conducted a total of 21 remote site interviews. A number of these sites had not as yet been activated as DDP nodes.
- INPUT's difficulties in arranging more remote interviews were frequently a result of a combination of factors including:
 - The fact that many systems were in the planning stages and not as yet operational.
 - Remote site personnel were regarded by the host as not sufficiently sophisticated to deal with the technical DDP issues to be raised during such an interview.
 - Some "remote" sites were actually physically co-located with the host.
- The EDP experience levels of those remote personnel encountered during interviews were substantially below their host counterparts. A number of them were clearly not DP professionals although they frequently had extensive experience as DP users.
- In many respects the remote operating system is "transparent" to the user in terms of its structure. He often deferred technically oriented questions to the host DP professional or simply was unable to form an opinion.
- Most users were heavily consulted during the system planning and design phase. Furthermore, the most important single criteria reported by respondents required for the success of DDP across all industry classifications was the necessity for involving the user in the planning and implementation process.

2. IMPACT OF COMMUNICATIONS

- It is important for INPUT to emphasize that during most of the discussions with both host and remote respondents on the issues surrounding communications we perceived a relative lack of insight and knowledge on this subject.
- In response to the question asking for the users' greatest concerns regarding communications, approximately 30% of the replies focused on reliability, speed and cost. The remaining responses varied widely, although it is interesting to note that approximately 13% of the respondents singled out error free transmission and telephone company maintenance.
- It should be noted that the more experienced DDP respondents were extremely sensitive to communications costs and related trends. INPUT suspects these respondents placed great emphasis on this variable in their DDP planning and deliberations with particular concern as to whether to distribute data bases or not.
- Approximately 70% of all DDP respondents expressed belief that advances in communications (satellite, increased VAN services, etc.) would favor in varying degrees increasing the acceptance of DDP. However, 25% of these respondents believed that such advances would have no effect.
- The overwhelming current transmission method reported by respondents was batch mode with increasing utilization of interactive over the next four years.
- However, in 1982 most respondents still expected to have batch mode remain the dominant communications method.
- There didn't seem to be particular concern over the extent to which host and remote sites might suffer communications disruption. Most respondents had implemented a combination of back-up procedures centering on a return to manual methods, the use of redundant hardware (or a cooperative host) or by the use of courier or mail service. Approximately 35% of all respondents felt that they could continue to operate without materially degrading business functions for 16-24 hours.

- Approximately 60% of all respondents expected their operations to degrade if the host and remote sites were uncoupled for more than one day.

3. OFFICE AUTOMATION

- Discussions regarding the effect that an increase in office automation would have on DDP plans within each respondents' company frequently resulted in total ignorance of the concept.
- The preceding is significant in that the least number of respondents questioned on this subject (survey question #14) believed it would have a major impact upon their DDP plans.
- Alternately, 28% of all respondents believed that it would have no effect on their DDP plans. This is one of the highest "no effect" response rates received during this portion of the interview.
- It is INPUT's distinct impression that only the largest and most sophisticated of the GSD-2 class of enterprises (particularly in the process, discrete manufacturing and college sectors) are currently in a position to address this issue.
- Although over 40% of the respondents mentioned some sort of tie-in between the host intelligence and other systems, there was a singular lack of sensitivity in interpreting this question to mean tieing-in with word processing or other office or process related systems functions. The discrete manufacturing sector was a singular exception to this last conclusion.

4. DDP STANDARDIZATION AND COMPATIBILITY

- A continuation in the lack of DDP standardization was regarded by close to 60% of all qualified DDP respondents as impairing the growth of DDP.

- Close to 20% of all respondents believed that the above issue would have no effect on their internal DDP plans. The basic reason for this position was a belief that the respondent could work around this problem; primarily by selecting a particular vendor and using the vendor's standards. Several such respondents went on to express concern, however, on being "locked in" to a single vendor.
- Close to 70% of all respondents believed that an increase in hardware and software compatibility would promote DDP acceptance. This issue, from a statistical point of view, ranked as the one generating the greatest respondent interest in this portion of the questionnaire (question #14) and was followed by the response to DDP standardization.
- Again in a later, more focused question (#22), approximately 80% of all respondents attached a high degree of importance to hardware compatibility in vendor selection.
- However, less than 20% of all respondents cited compatibility with existing hardware or IBM protocols as the most important factors in DDP vendor selection (question #19).
- The standardization issue was not singled out as being critical by respondents identifying what their greatest concerns were involving DDP communications.
- Similarly, respondents also did not regard standards and compatibility issues as important criteria for determining the success or failure of DDP in their respective industries.
- Only 15% of all respondents identified a lack of multiproduct compatibility or standardization as a negative DDP factor.
- Not surprisingly, INPUT concludes that a continued lack of hardware/software compatibility and DDP standardization will reduce the rate of DDP implementation but certainly not stop it.

- Alternately, a solution to both of these problems could materially accelerate acceptance of the concept.

5. ISSUES SURROUNDING REGULATION AND SECURITY

- In general, respondents' reactions as to the impact of government regulation, power limitations, etc., on their DDP planning were tepid. Approximately 30% of all DDP respondents thought there would be no effect by such events, probably as a result of their not being aware of any particular actions influencing their business.
- Individual respondents seized on industry unique regulatory action to highlight how such action might accelerate DDP. For example, state legislation requiring more detailed patient prescription records to be kept by pharmacies is regarded as an impetus to DDP in the retail drug business.
- Alternately, a motor freight respondent regarded increasing Interstate Commerce Commission (ICC) requirements for record duplication as an impediment to DDP because of uncertainty as to how such information would be distributed.
- However, many of these regulatory issues (both favorable and unfavorable) would seem to present interesting market opportunities for DP vendors pursuing DDP or other types of application solutions.
- Reactions to the issue of security was also greeted in a somewhat disinterested fashion.
- Current security concerns for both host and remote machines focused on positive user identification and the capability of developing audit trails.
- Encryption of either communications or data base information at either small or large machine sites was widely viewed as unimportant for both the present and future.

- Future visibility on these security issues appeared extremely limited. Nonetheless respondents continued to cite positive user identification and audit trail requirements as of most concern in the future.

6. SYSTEMS ARCHITECTURE AND KEY APPLICATIONS

- The type of DDP network architecture most frequently identified as being employed in current or planned installations is a star configuration.
 - Industries reporting its dominant use were principally wholesale, retail and the non-petroleum process industry respondents.
- Considering the relatively embryonic state of current DDP acceptance and implementation, INPUT regards the use of a star architecture as not surprising.
 - Pilot installations appear to be currently structured so as to distribute the data processing function only one level removed from the host; i.e., a star pattern.
- As DDP becomes a more accepted data processing concept, INPUT would expect the increased development of hierarchical networks suggesting intelligence nodes further removed from the host.
- Both the banking and discrete manufacturing industries exhibited a relatively high incidence of hierarchical networks. Perhaps this is due to the more advanced state of acceptance and development of the DDP concept in these market segments.
- INPUT encountered extremely limited evidence of ring network implementation with or without a host. We attribute this to both the limited sample size and the relatively more sophisticated and complex nature of such a structure.

- Other work that INPUT is performing suggests that there are applications areas, particularly in discrete manufacturing, to provide future support for ring architectures.
- No surprises were evidenced in the reported primary applications performed by host respondents. Heavy emphasis was placed on traditional business accounting functions including in descending order of reported frequency:
 - Accounts receivable (43% of host respondents).
 - Accounts payable (40% of host respondents).
 - General ledger (35% of host respondents).
 - Payroll and labor distribution (30% of host respondents).
 - Inventory accounting and control (26% of host respondents).
 - Order entry (26% of host respondents).
 - Sales analysis (21% of host respondents).
- Not surprisingly, the above applications were closely correlated with the most frequent responses of non-DDP interviews even though INPUT found it much more difficult to sustain this part of the dialogue in its telephone contacts.
- In moving beyond these common applications, each segment consistently reported industry peculiar applications; e.g., grade reporting in schools and colleges, admissions and discharge in hospitals, etc.
- No material changes resulted in the reported applications when the replies from remote respondents were also factored into the analysis.

- Approximately 50% of the respondents identified order entry, organizational recordkeeping, invoicing and inventory control as key applications to be performed using DDP communications.
- It is INPUT's belief that DDP will not of itself spawn significant additional new applications in the short term but rather will be used to provide cost/performance improvements over existing DP methods to perform these same applications.

7. DDP JUSTIFICATION AND THE DECISION MAKING PROCESS

- The decision to adopt a DDP network seems to evolve over an extended period of time within both large and small enterprises. Indeed the distribution of intelligence appears to have been underway in some industries; e.g., banking, long before the phrase "DDP" was apparently formulated.
- A variety of factors were frequently cited as contributing toward this evolution and included:
 - A desire to off-load the host and stop the seemingly endless upward mainframe migration.
 - User complaints regarding the accuracy and timeliness of information provided to them.
 - Rapid growth of the users' business area of responsibility and consequently a need to expand his DP utilization.
- Alternately, the demands of a dynamic marketplace or management's desire to continue to grow rapidly (or gain market share) are supported by proposed DDP solutions.
- Merger and acquisition activities also occasioned DDP implementations; in some instances to aid in the integration (and establishment of control) of the new entity within the acquiring enterprise.

- Irrespective of the exact combination of causal factors, a study of a possible move to DDP is usually initiated at the senior DP or operating management levels. Complaints filtering through to senior management from user groups have also played a role in triggering this process.
- By far the most frequently employed justification procedure reported by respondents (in two-thirds of the cases) was related to the performance of some form of cost/benefit analysis.
- As part of this analysis a variety of alternate DP methods were evaluated for DDP replacement and subsequently eliminated upon implementing a DDP system. These included in descending order of frequency of occurrence:
 - Batch processing.
 - Manual methods.
 - On-line data entry.
 - Centralized processing.
 - Key punch.
- It appeared to INPUT that formalized profit and loss impact, payback, or ROI analyses were probably conducted only in the largest types of GSD-2 enterprises. Smaller companies placed more emphasis on recognition of operating bottlenecks and the need to take positive action to relieve these problems. It was frequently intuitively assumed that positive cost benefits would be derived as a result of employing a DDP approach.
- Additionally, once the president, owner/manager or chief operating officer was sold on the idea through whatever sequence of events, DDP was just going to get done!

- INPUT concludes that although DDP is widely assumed to be cost effective, detailed concrete analyses supporting this hypothesis are currently lacking.
- Once the decision is made to go to DDP the usual sequence of events transpire including further system refinements, request for quotes and the implementation of some form of a pilot installation.
- It was not clear as a result of this study as to the average amount of time required to go through all of these phases but it is INPUT's sense that in no case was it less than 12-18 months. As a function of the size and rate of growth of the enterprise the implementation process could easily take years.
- By way of reinforcing the preceding, senior DP management had extremely limited visibility beyond the 1980 timeframe as to their hardware requirements and the expected rate of system growth.

8. CENTRALIZED VS. DECENTRALIZED CONTROL

- Both host and remote respondents overwhelmingly indicated that their DDP systems development and equipment procurement were centrally controlled.
- Over 80% and 50% respectively of total DDP respondents indicated that current and future system development would be controlled through the corporate parent in a centralized management structure.
 - Even decentralized companies with relatively autonomous operations maintain central control through a divisional or group DP operation.
- Similarly, over 80% and 50% of total DDP respondents articulated the same strong centralized control philosophy in current and future equipment procurement respectively.
- This same recurring theme of strong centralized control was particularly evident in the smaller (GSD-I) enterprises which are frequently family owned and operated in almost an autocratic manner.

9. DATA BASE DISTRIBUTION

- Approximately 55% of the DDP host respondents stated their intention to distribute data bases. However, in a great many cases this was interpreted to mean a redundant subset of files rather than a standalone or general purpose local file.
- The decision to distribute data bases depends heavily on the organizational structure of the enterprise with highly centralized entities having centralized data bases with little inclination to distribute.
- It is INPUT's distinct impression that there is little understanding or technical agreement on how such distribution is to be achieved. Informed users were lacking in optimism that a proven distributed data base management software package will be available shortly. Less experienced smaller users seemed to have little exposure to a DBMS concept.
- Users are extremely sensitive to the availability of high grade and lower cost data communications facilities. Future decisions relating to data base distribution will pivot heavily on this factor.
- Principal reasons offered to support distribution centered on security issues, the need to make accessible remotely key record information, lower communications costs, and in general the need to improve data integrity and the timeliness of information reporting.
- Size of nodal data bases varied over a broad range of values. Respondents reported storage requirements below one megabyte in several interviews while data base requirements in excess of 100 megabytes were reported in other interviews.
- The most common techniques employed for distribution is to download key files (inventory, customer lists, shipments, etc.) or a geographic subset to the remote site. Depending upon the dynamics of the enterprise's business, these files may be updated several times a day or only once per week.

10. SOFTWARE ISSUES

- Although reliability and maintenance capabilities were the single most important factors in DDP vendor selection, software capabilities (including its ease of use and support) were singled out as important by approximately one-third of the total DDP respondents.
- Software related issues were regarded with somewhat less concern by DDP respondents when asked to identify the most important criteria for the success or failure of DDP within their respective industries. Approximately 20% of the sample pinpointed software reliability, availability, ease of use and standardization as concerns.
- This 20% response factor was also repeated when respondents were asked to identify the negative factors associated with DDP and cited software related factors.
- Respondents overwhelmingly believed that an increase in hardware/software compatibility would have the most important positive impact on DDP growth of the five issues discussed in question #14 (For your company what impact will the following have on DDP?).
- As noted earlier, most informed respondents cited a singular lack in the availability of a proven data base management software package. Pending such availability, respondents had serious concerns about undertaking the distribution of data bases.
- The compatibility of software and the diversity of software languages that were available to the market were ranked as extremely important factors that DDP respondents considered in selecting vendors.
- Alternately, the availability of applications software was regarded as significantly less important by DDP respondents. Only 13% or 18 of the non-DDP respondents said they would go to DDP if a vendor offered applications software. Fifty-five non-DDP respondents said categorically "no"; i.e., vendor offered applications software. was not an inducement to go DDP.

- Seventy-five percent of host respondents cited in-house sources for applications software with about 33% citing vendor and third party sources.
- COBOL was by far (a factor of 3-4 times) the software language most used. Other languages used included BASIC, RPG, FORTRAN, and assembler which were mentioned with equal frequency.
- Respondents seemed to be less conversant with network software and communications protocols sometimes confusing the two. Bisync and SDLC were the two protocols most frequently mentioned as being used.
- Not surprisingly, applications software was maintained by two-thirds of the host respondents while close to 70% of the respondents had their communications software maintained by vendors.

II. DDP PROS AND CONS

- The most important criteria consistently mentioned (45% of all DDP respondents) as determining the success or failure of DDP across all industry sectors was the need for detailed planning by the user in implementing a DDP system.
 - Users privately commented that this lack of planning, in conjunction with an incomplete understanding of systems performance capabilities and complexities, have frequently led in the past to disastrous DP experiences.
- Cost/performance features ranked a distant second. Surprisingly, the reliability and maintenance support issues, which are singled out by users elsewhere as the most important factors in DDP vendor selection, were relatively infrequently mentioned (less than 15% by all DDP respondents) in response to this question.

- The single greatest reported motivator for adopting a DDP system was to move data management and control to the data source and principal user.
 - Timeliness of information reporting and expectations for improved cost performance benefits were also statistically significant responses.
- Although off-loading the mainframe was only specifically singled out by 5% of all respondents, its importance is significantly higher than this statistic would suggest.
 - Private comments in most industry sectors, and particularly in banking, cited mainframe capacity limitations as a major DDP driving force.
- This conclusion may possibly be statistically supported if the following relatively vague comments may be grouped together and related to host capacity or other limitations:
 - "Timeliness of information reporting."
 - "Inefficiencies of a centralized system."
 - "Better throughput."
 - "Off-load mainframe."
- The above exercise yields a total response of 45% amongst all DDP respondents.
- The most significant positive DDP factor identified by 50% of all respondents was the cost performance benefits experienced or anticipated.
- Several other statistically significant positive factors that were mentioned included:
 - Timeliness of results/increased throughput (38%).

- Data accessibility for the end user (29%).
- Reduction in mainframe usage (18%).
- The most concern or negative factor mentioned by respondents regarding DDP was the loss of control which was cited by almost one-third of the respondents.
- Other frequently mentioned negative factors included:
 - Expected administrative operating complexities (25%).
 - Possible end user confusion and the increased need for field support and training (23%).
 - The greater degree of communications dependence (20%).
- However, with all of the preceding said, approximately two-thirds of all DDP respondents reported DDP satisfaction ranging from good to outstanding. Less than 5% of all respondents characterized their experience as poor.

12. NON-DDP USER PROFILES

- Over 135 telephone interviews were conducted with non-DDP users with heavy emphasis in the wholesale, retail and discrete manufacturing areas. This resulted from the lack of success INPUT experienced in finding qualified DDP respondents in the GSD-I range of enterprises within these market sectors.
- Non-DDP respondents were generally the senior DP functionaries within the enterprise and were usually physically located at corporate headquarters. This was frequently co-located with a warehousing, manufacturing or sales operation.
- Over 50% of these interviews were conducted with GSD-I enterprises.

- Not surprisingly, EDP experience levels were significantly below those encountered in the qualified DDP sample. For example, 75% of the qualified DDP respondents had 9 or more years of EDP experience while only 39% of the non-DDP respondents could make that claim.
- Similarly, 60% of DDP respondents claimed varying amounts of prior DDP experience while less than 17% of the non-DDP respondents could make such a claim. It should be added that many of these respondents had not even heard of DDP.
- The most consistently stated reason for not implementing a DDP system was a belief that the enterprise was too small (over 20%). However, when combining both a stated preference for centralization and a stated belief that the centralized system fulfills the DP needs a response rate approaching 25% was recorded.
- In defining DDP strengths, non-DDP respondents cited many of the same factors as did DDP respondents including timeliness of information reporting and moving control and flexibility of data handling to the source as well as unloading the mainframe.
- Surprisingly, very few of these respondents mentioned reduced cost or cost performance benefits as DDP strengths although there was some belief that the concept was too costly.
- Loss of central control, as in the DDP respondents sample, was most frequently highlighted as a DDP weakness.
- By far the most frequent factors that were given for considering DDP in the future related to increased size of the enterprise and a fundamental change being required within the company; i.e., management would have to increase its commitment or confidence in DP.

- Limited visibility existed as to when DDP would next be evaluated within the enterprise much less as to which key applications might be considered for implementation.
- Little evidence existed as to whether other systems were tied into the host intelligence.
- Primary applications performed at these sites were quite similar to those reported by DDP respondents.
- It is worthy to note that only 13% of these non-DDP respondents believed that vendor supplied applications software would be a sufficient inducement to go to a DDP system. This seems to be consistent with the relatively low level of importance assigned to this issue by DDP respondents.
- Two last comments are worthy of note before concluding this section. They are that:
 - A number of these telephone interviews were conducted with seemingly harried individuals who were perfunctory in their remarks; i.e., they weren't particularly thrilled to take the time to discuss these issues.
 - Many of the respondents were clearly ignorant of the DDP concept and either ill disposed to demonstrate this ignorance or not qualified to fully reflect on some of these issues.

13. VENDOR RELATED ISSUES

a. Factors In Vendor Selection

- The two most important and dominant factors articulated by both host and remote DDP respondents in vendor selection were the:
 - Reliability of the equipment and software.

- The vendor's ability to provide maintenance support.

- Cost/performance features as well as software compatibility were also frequently mentioned but are somewhat lower in importance.
- It is interesting to compare the above results with more focused questions asked in another part of the interview (question #21) which yielded substantially the same results as above.
- Hardware ease of training and use, in conjunction with the diversity of software languages offered by vendors, ranked relatively highly.
- It is important to note that such factors as "one stop shopping" and the availability of applications software were of least importance.

b. User Attitudes Toward Vendors

- Of the total host and remote respondents polled, both DEC and IBM were regarded as the most influential in promoting the DDP concept.
- It's important to emphasize that IBM's position in the above ranking was achieved almost exclusively in the eyes of respondents by virtue of such recent new product offerings as the Series/1 and System 34.
- Frequent mention was also made of Hewlett-Packard, Datapoint, and Data General.
- No other traditional mainframe vendor was mentioned with any frequency other than Honeywell which was relatively often singled out in the process (non-oil) industry sector.
- Not surprisingly, IBM was singled out as the vendor that was most inhibiting in promoting the DDP concept.

- No other vendor came close in response to this question.
- However, it is important to note that IBM was accorded this dubious distinction by respondents largely as a result of what was perceived as the traditional product/market strategy of its DPD group.

C. USER/NON-USER DDP ANALYSIS BY INDUSTRY SECTOR

I. WHOLESALE

a. Overview And Conclusions

- The wholesale industry is characterized by a large number of small-to-medium sized, family-owned, local or regional businesses.
- Return on equity is typically less than 10% and gross profit margins are in the 1-1/2 to 2% range.
- Any capital improvements must therefore show an immediate improvement in operating conditions or they will not be adopted.
- Problems of inventory management, order entry, billing, truck routing, credit authorization have all been among the earliest applications to be solved by data processing and are susceptible to the same kinds of solutions in wholesale trade.
- Yet almost without exception, firms in wholesaling characterize their businesses as unique and not subject to a standardized application package without extensive modifications. Such changes would waste all the investment previously made in developing their own customized software.

- The current DP trends in wholesaling are only now progressing away from mail or courier transmission of paper documents to headquarters for entry into a batch system. These methods are being replaced by a local cluster of on-line terminals at headquarters and/or a key-to-disk polled terminal at the remote locations. Most output is still produced centrally, then sent by mail or courier to remote locations. Information flow is primarily toward headquarters, rather than toward the branches.
- Consequently, few firms in wholesaling have already implemented DDP.
- Nearly half of the firms in wholesaling that claimed to be planning or doing DDP refused to be interviewed, often citing their heavy operating workload as the reason. However, considering the industry's DP backwardness, these claims are suspect.
- Basically, the wholesale industry appears to be 5-10 years behind the leaders in distributed data processing techniques and applications.
- Accordingly, INPUT regards the wholesale industry as one of the least promising industry groups for DDP implementation over at least the next five years.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- Of the 12 industry sectors studied, the wholesale industry ranks dead last in sophistication of data processing. DDP is almost non-existent.
- Eleven out of 76 companies contacted claimed to be doing or planning DDP; 4 of these refused to be interviewed.
- Only 1 of 24 companies with 20-99 employees was found to be doing DDP; 12 were not, but furnished some information; 11 were not, and did not furnish any further information.

- Four of 18 companies with 100-249 employees claimed to be doing DDP; 3 of these refused interviews.
 - Nine more were not doing DDP, but furnished some information.
 - Five more were not doing DDP, and did not furnish any further information.
- Three of 20 companies with 250-999 employees were found to be doing some basic form of DDP; 1 additional company claimed to be doing DDP but refused an interview.
 - Twelve companies were not, but furnished some information.
 - Four companies were not, and did not furnish any further information.
- At the higher ranges, 1 of 10 companies with 1000-9999 employees was doing DDP.
 - Three were not, but furnished some information.
 - Six were not, and did not furnish any information.
- One of 3 companies in the 10,000+ category was doing DDP; two were not; and the third refused any information.
- Only 1 company (in the 250-999 range) was using an outside service as a solution to their communication problems.
- There is a pervasive reluctance in this industry for top and middle management to use or trust any form of data processing.
- Considerable confusion exists in the responses of interviewees as to what constitutes DDP:

- Many firms equate the presence of CRT terminals with DDP.
- A large number of firms still operate as primitive card-oriented shops.
- Two-thirds of the non-DDP respondents' top DP managers had 8 years or less experience with data processing, whereas all of the DDP respondents' top DP managers had 9-20 years of experience or more and most had 14 years or more.
- Only the largest companies have been doing DDP for 1-5 years; the balance are still planning or just starting to implement their systems.
- Only one company used a study of what other users are doing as a basis for their own decision to go to DDP. Possibly this is a function of the small number of firms in the wholesale industry already doing DDP.
- Even for those companies who are planning or considering DDP, very little thought seems to have been given to timing, schedule of implementation, primary applications to be performed beyond one or two critical ones, or consideration of potential pitfalls and weaknesses of DDP. The primary implied motivation for choosing DDP (not necessarily the primary stated motivation) is to survive in the face of rapidly increasing workloads and not necessarily capture reduction in operating costs.
- The overwhelming impression is that of a market whose data processing practices are primitive, but whose management is very cautious and too harassed by business pressures to consider a technique they believe is overly sophisticated for their companies.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- Companies in the wholesale industry are organized in traditional ways, with managers of geographic branches reporting to the corporate VP of sales and/or operations.

- DP is a typically central function and reports to the chief corporate financial officer.
- Top management style and intentions are clearly reflected in the decision as to whether or not to implement DDP.
- In almost all of the current implementations, the president or vice-president was the sole impetus or was directly involved in the decision to go DDP.
- On the negative side, statements were made that:
 - "It's too hard to buck anti-DDP ideas."
 - "President and 2 VPs own all stock. Any kind of DP has been very difficult to get going. Idea and traditions are great barriers."
 - "Had considered DDP but company management wants to retain tighter central control."
 - "Ask Atlanta (company HQ) why we aren't doing DDP."
 - "There will be no change in our data processing philosophy until corporate management can put together a long range plan."

(3) Current And Anticipated Application Structures

- The overwhelming key DDP application in wholesale is order entry, followed by billing, inventory control, and accounts receivable, normally implemented in that order.
- Other applications in the accounting and financial group were mentioned, but it is not clear whether they would be performed at the host or the remote site. In many cases the decision had not yet been made.

- Very few companies in the lower size range of the wholesale industry are doing or considering industry-specific applications such as big ticket inquiry/reservations, shelf-price labeling, route accounting, and stock replenishment, and none were planning to do it on a remote basis.
 - The largest interviewed company does some industry specific processing on the host with output printed at the remote sites.
- Planning and staging of applications to be implemented in DDP has not progressed beyond an early stage with few exceptions:
 - One company (a 500 employee non-ferrous metals distributor) has a plan to implement inventory control now, followed by order entry, billing, and accounts receivable at two-year intervals. However, this company expects to replace its three year old distributed minis with non-intelligent terminals in two years and revert to non-DDP status.
- Companies in the wholesale industry did not see increased word processing as a significant trend in their industry nor did they see it as a tie-in to any of their other systems. About half of the companies felt increased office automation development would cause some increase of DDP; none saw it as causing a decrease in DDP.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- Fast customer service is a vital business concern that was consistently voiced within the wholesale industry.
- DDP is seen by its users as contributing to better customer service and is therefore a primary motivating factor.
 - One remote user said he was "going to DDP out of desperation! The (apparel) business is changing dramatically; there are too many customers. (We are) overwhelmed - just need something to help!"

- Improved cash flow is related to faster customer service.
 - One respondent calculated total payback of the new DDP system in less than 1 year, based on eliminating the current 15 day lag between placement of order (mailing the order to HQ) and sending the bill to the customer.
- Because the industry operates on very low profit margins, cost/benefit ratios are also important.
 - Most users felt costs were easy to justify.
 - A few users felt cost considerations were very subordinate to service improvement and business survival conditions (dealing with vastly increased workloads).
 - Most non-DDP users, on the other hand, felt they could not justify DDP expenditures - particularly for remote peripherals and increased operating personnel.
- The information flow time constraints in wholesale and the volatility of data are relatively low concerns. Respondents were not concerned about the possibility of the data base being unavailable for periods ranging from 2 hours to 3 or 4 days. Consequently, most companies do not see DDP as an advantage in this regard.
- DDP is replacing distributed data entry systems (polled key to disk).
 - One user is going directly to DDP from a conventional card-oriented batch system.
 - A very large user is replacing optical scanning by electronic order entry.

- Many non-DDP users have just made or are planning the transition from batched systems to on-line data entry and do not see themselves taking the next step to DDP for three to five years or longer.
- Typical reasons for not using DDP were:
 - "We are too small." (400 employee sand-gravel-concrete distribution company)
 - "Our present equipment is satisfactory."
 - (DDP is) "too sophisticated for us." (40 employee MUE handling electrical supplies).
 - "We are a central resource, want to keep all files here."
 - "Staff competence at remote locations is not high enough; they had a lot of trouble adapting to accounting machines."
 - "Time pressures at remote locations are not that severe." (Ready-mix concrete distributor with very complicated pricing structure).
 - "It is easier to mail and process centrally."
 - "Will never consider (DDP) - branches tried to form themselves as separate companies, built own empires; we're trying to get back to one company again."
 - "Need for information on a quick on-line basis is not crucial." (300 employee scrap metal wholesaler).

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Unexpectedly, all but the largest company have already distributed or are planning to distribute their data base.
- • In every case, the distributed portion will be a redundant subset of files rather than a standalone local file.
- In no case is a DBMS in use, although several are under consideration.
- Reasons for distributing the data base comprise a combination of factors such as security, accessibility, lower cost than adding extra communications lines, and greater integrity and timeliness of information.
- The most common technique employed is to download the inventory and customer files (or a geographic subset of them) to the regional location. Usually there will be a centrally polled batch update of HQ shipments files, and a weekly update of billing and open item files back to the regional location. Additional files, such as tax files or the full customer file, may have to be sent to the customer location, depending on where billing is performed. Sizes of nodal data bases range from 1-100 megabytes, with a median value in the 15-27 megabyte range.
- Problems and concerns about communications relate more to reliability, integrity, accuracy, and security rather than cost, but nearly one-third of the companies felt that they had no problems or concerns about communications at all.
 - One user felt that it is imperative to "get the Feds out of the communications business," because it increases the difficulties and raises the cost of communications.

- Back-up is seen to be a major problem for a small business.
 - Distributing the data base is recognized as a partial solution to this problem.
 - However, over half the respondents propose reverting to manual preparation of paper documents as the primary or ultimate back-up - another indication of the low state of progress of DDP in this industry.
- Key DDP applications for this industry, while they tended to have time constraints, did not consider these constraints severe, since the application could be down from 2 hours to 72+ hours before triggering a back-up system.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- As in most industries, reliability and maintenance capability were ranked the highest as critical factors in vendor selection.
 - One hundred percent of companies in wholesale rated these factors critical or very important compared to 91% and 77% for all companies combined.
- Compatibility of software and product price/performance were ranked next, slightly above but in line with the combined total of respondents in all industries.
 - Eighty-six percent of wholesale companies rated these factors critical or very important compared to 75% and 72% respectively for all companies combined.
- Vendor image/viability was considered critical or very important by 71% of the wholesale companies, far above the combined total of 50% of all companies surveyed. This factor was considered by the wholesale companies to be equally important to software language ability and compatibility of hardware, rated 68% and 72% by all companies combined respectively.

- IBM, Hewlett-Packard, Datapoint, and Four Phase were mentioned by about half of the wholesale companies as influential in promoting the success of DDP.
- Eight other mini and mainframe manufacturers were mentioned by name in the same context.
- Falling close to or above the median in numbers of responses in the wholesale industry were such factors as ease of training and use, one-stop hardware shopping, and the availability of network interconnect with software.
 - Fifty-seven percent of wholesale firms rated these factors as critical or very important compared to 61%, 27%, and 49% of the combined total of all companies respectively.
- Ranked less important by wholesale companies were terms and conditions, volume discounts, and somewhat surprisingly the availability of applications software. However, the latter coincides with a broad response by non-DDP users that their applications (within the wholesale industry) are unique to each company and would not be likely to be available from any hardware or software vendor.
 - Fourteen percent of wholesale companies rated these factors critical or very important, compared to 20%, 37%, and 37% of the combined total of companies respectively.
 - Among the unique application characteristics cited were the high number of different products handled (paper goods/packaging/housewares distribution), the complexity of the pricing structure (a sand, gravel, and concrete distributor), the necessity to bill direct to the small retailer for 1 or 2 case lots (a specialty food distributor), and the operating characteristics of the apparel industry compared to wholesaling in general.

(7) The Future For Remote And Host Participants

- In the wholesale industry, only one company would consent to a remote interview. Most companies offered the explanation that they were not involved in DDP long enough to make the interview of value.
- Based upon other questions and comments, it was apparent that remote locations play little or no active role in the decision to go DDP or in the subsequent selection and design practice.
- In fact, the decision to go DDP is almost always made by the president or vice-president, and in some cases even bypasses or results in the replacement of the DP manager.
- Remote location DDP participants tend to operate at the level of order clerk or billing clerk, rather than in a professional position.
- A significant assumption in the decision to go DDP rather than to establish an independent DP function at the remote location is the avoidance of placing DP staff at the remote location.
- The one interview with a remote participant strongly confirmed that a primary motivation to go DDP is to cope with vastly increased workloads in a high growth business.
- The manager of the remote facility also felt DDP would make him able to provide better service based upon faster turnaround of information.
- The future growth of DDP at remote locations will be much more highly dependent on selling management at the host rather than selling the end user.
 - Only in companies that are struggling with greatly increased workloads due to rapid growth in the customer base is there pressure from remotes to upgrade DP capability.
 - Most companies will still be run autocratically.

- Easily customized applications software for specific sub-segments of the wholesale trade will offer a selling advantage over general purpose software.
- Office automation will have little impact on the development of DDP in wholesaling. There is no consensus as to any factor that will have a major impact, except that an increase in software/hardware compatibility will tend to make more products available, possibly at a lower cost to the user.
- Based on our sampling, almost all communication will continue to be from remote to host, rather than host to remote or remote to remote.

2. RETAIL

a. Overview And Conclusions

- Of the 12 industry sectors examined during the course of this study, INPUT views the retailing sector as currently exhibiting a DDP sensitivity that is about average within the United States. That is, the degree to which the industry seems to be moving toward the implementation of DDP is less well advanced than the process, banking, discrete and college segments. Alternately, it seems to be in advance of wholesaling and the remaining service sectors in adopting DDP.
- Within the distribution industry, INPUT believes that the extent to which DDP is being implemented in 1977/78 for retailing far exceeds the wholesale sector. Furthermore, it is INPUT's current position that the rate of retail industry adoption of DDP methods in the post-1980 time frame could sharply accelerate as a function of developments in electronic funds transfer, POS and state regulating actions. A number of leading edge retailers also appear to be employing DDP in an effort to sustain rapid growth while also increasing competitive pressures (gaining market share) upon others within the industry.

- INPUT encountered great difficulty in finding qualified DDP installations within the GSD-I enterprise range. Out of a total of approximately 55 retail GSD-I telephone contacts, which resulted in five on-site interviews, only one enterprise was found to be planning to employ a DDP system later in 1978. Of the remaining four on-site interviews in the GSD-I range, one retailer was employing a star pattern of non-intelligent terminals for credit verification (non-DDP) and the remaining three enterprises (none of whom were doing DDP) were interviewed for purposes of collecting more detailed case study information.
- The principal reasons for the lack of DDP acceptance within the GSD-I range of retail enterprises are, in INPUT's judgement, the following:
 - A generally lower level of DP sophistication leading to widespread ignorance of the potential benefits of a DDP approach.
 - DP occupies a lower level of importance within the corporate entity, frequently as a result of past negative experiences with implementing a data processing system; i.e., cost/performance benefits have yet to be successfully demonstrated.
- The seemingly frenetic daily demands of running a small business seems to afford little time for long range planning and DP trade-offs. Exhibits III-1 and III-2 offer paraphrased comments from both telephone and on-site interviews of non-DDP users.
- The current breakpoint separating those enterprises that are moving toward DDP from those that are not appears to be in the 1,000-2,000 employee range. The number of actual DDP installations were limited with most companies either in the planning or pilot evaluation stage. However, reported experience to date was generally quite favorable with expectations for an acceleration of installations over the next 12 months.
- Principal DDP applications centered on inventory control, store replenishment and trend indications on "hot" selling items. DDP systems (and definitions) are being tailored to specific (custom) requirements.

EXHIBIT III-I

RETAIL - NON-DDP TELEPHONE INTERVIEWS

- "An IBM System 20/30 was installed in 1973. Additions were made to the system until it failed. No documentation - no training. The system is now being removed and the company will either go to a service bureau or return to manual operations."
- "I'm so busy with my Honeywell upgrade I can't consider it."
- "We're too centralized an organization . . . the president would never consider it . . . we'd lose control of the data."
- "Further software advances are required in communications and data base management."
- "It would take us back to the old system of every man for himself."
- "The machine we have now will last for 10 years - like the last one did."
- "What is it?"
- "It's useful for a strong centralized company . . . our corporate structure is mean and lean . . . we're highly decentralized . . . see no need for complicating operations."
- "We're not geographically dispersed . . . we'd be better served by a minicomputer or small mainframe."

EXHIBIT III-2

RETAIL - NON-DDP ON-SITE INTERVIEWS

COMPANY NO. 1 (125 employees, office furniture consultant/supplier)

- "Company not sufficiently diversified."
- "We tried it, but our users couldn't handle intelligent terminals."
- "Applications software didn't work."
- "Expected a reduction in DP costs by buying its own system and discontinuing the use of a service bureau."

COMPANY NO. 2 (150-175 employees, women's specialty shop)

- "It wouldn't be cost effective for our business."
- "We would have to grow quite a bit."
- "Prove to me that DDP can do a better job (faster, more profit) then the methods I'm using now."
- "We would consider DDP if somebody offered applications software and proved to us that it would save us money and be capable of being run on our System 3."

COMPANY NO. 3 (200-250 employees, women's fashions)

- "Current management has had 5 years of DP problems and are still very dubious of the DP function."
- "Vendors have not properly addressed retail industry problems, particularly with regard to performing the total POS function."
- "I still don't have inventory control on my computer."
- "I'd like a packaged solution to my problems."
- "It is also interesting to note that the DP Manager interviewed at this establishment had about 5 years of DDP experience out of a total 10 year career in the DP industry. He was moved to comment that his company will be downgrading to smaller machines which are just too powerful and negate the need for large machines."

- Driving forces propelling the move to DDP were related to increased timeliness and accuracy of user information, greater user involvement, competitive factors and cost/performance benefits. However, with some exceptions, INPUT does not believe there were particularly detailed cost and ROI analyses conducted to support a decision to implement a DDP system.
- Off-loading the mainframe was also frequently mentioned during the course of a number of on-site interviews.
- There is extremely strong centralized control of the system planning and procurement functions. Most users had little or no professional DP experience and relied heavily on corporate decision making.
- Extremely limited sensitivity existed with regard to tying host or remote intelligence into word processing or other applications. Respondents were somewhat more concerned about security but INPUT does not believe that this issue enjoys a high priority within most retail organizations.
- Most respondents wrote their own applications software which served to reinforce frequent statements that retail industry applications packages were not useful.
- Digital Equipment Corporation, closely followed by IBM, was the company most frequently mentioned as supporting DDP. However, IBM was mentioned in this context largely as a result of such recent product introductions as the Series/1 and System 34.
- IBM continued to be singled out as the company most inhibiting to DDP growth with some comments as to the company's lack of a fully competitive DDP product family.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- Relatively little difficulty was encountered in finding and interviewing qualified DDP respondents in the GSD-2 range of companies. However, of the 10 qualified on-site interviews conducted in this category, most DDP systems were in the planning stages with remote sites not expected to be operational for 6-12 months.
- Although these sites are intended to serve local needs, INPUT was left with a very strong sense of centralized planning and control with the prospect of a long evolutionary process before greater remote autonomy may be forthcoming. Representative comments for employing DDP are to be found in Exhibit III-3.
- INPUT was singularly unsuccessful in locating qualified DDP users in companies where the total number of employees was below 1,000. The closest was one regional sporting goods chain preparing to install NCR ECR equipment in 1978 with a reported capability of downloading software to master store registers.
- Consistent with the experience levels of the total number of sampled respondents, more than 75% of the retail host respondents had in excess of 10 years of DP experience.
- Organizationally, retail DP management is similar to other industry sectors in that it reports into the financial side of operations. However, the degree of DP importance within the retail enterprise generally decreases with the size of the company.
- Not surprisingly, DDP experience levels scaled down substantially with most retail respondents claiming less than five years of experience. This is consistent with the limited extent to which the proposed DDP systems had actually been implemented.

EXHIBIT III-3

REASONS FOR GOING TO DDP

- "Batch processing, with its attendant time delays, is a disaster for the rapidly changing retail business. "
- "Don't want to rely on communications on a real time basis."
- "Improve retail warehousing and either delay a new warehouse or mainframe."
- "My 360/40 can't do the total DP job. Besides, it is improperly configured to do my expanded warehouse job and is not an on-line machine."
- "DDP is a necessity - retailing is a cut-throat business and we need all the help we can get to be competitive."
- "We need to get clear data from users. "

- It is instructive to further comment that the degree of DP sophistication and expertise at all levels in the retail sample seemed below those encountered in the other sectors or industry groups.
- Equipment that was either planned or currently installed at remote sites ranged from:
 - Non-intelligent terminals used for credit verification and obviously not part of a "true" DDP system to ,
 - NCR programmable (down-loaded from the host) ECRs for POS applications to,
 - True minicomputers installed at warehouses or regional distribution centers for purposes of facilitating inventory management and replenishment operations at the local store level.
- Although most of the qualified DDP respondents reinforced that the basic DDP concept pivoted on the use of remote programmable intelligence, each of their DDP systems were customized and focused with regard to specific applications. See Exhibit III-4 listing some representative DDP definitions.
- Alternately, many of the non-DDP respondents, particularly in the small GSD-I category, could not define DDP even in a rudimentary fashion. Reasons given for not implementing DDP by those non-DDP respondents who were familiar with the concept seemed to be widespread but generally included:
 - Being too small.
 - A fear of losing control of their data.
 - A belief that the respondent had not as yet taken full advantage of a centralized facility much less being in a position to decentralize.

EXHIBIT III-4

REPRESENTATIVE DDP DEFINITIONS

- "Logic at end of line made available by communications links."
- "Collecting data outside of the mainframe and after extensive editing and preprocessing, forwarding information to the host in batch mode."
- "Distributing data functions as near to the source as possible. Communications are essential."
- "Processing at multiple points."

- Of the three non-DDP on-site interviews conducted in retailing, all had:
 - Less than 250 personnel and were principally family owned and managed.
 - Either been "burned" by significant DP problems in the past or were not now fully utilizing the host capabilities.
 - Not conducted any material cost/benefit analyses with regard to their current DP operations much less with respect to a DDP implementation.
 - Requirements for significant vendor support.
- As a result of the preceding, INPUT is left with a strong sense that the distribution services industries in the U.S. are quite removed from the DDP mainstream with retail evidencing more sensitivity to DDP issues and trends than is the wholesale sector. Furthermore, DDP did not seem to evolve as a "pure concept" but rather as a solution to one or more specific company problems.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- All host respondents were interviewed at their corporate headquarters and clearly represented the enterprise's management and organizational operating philosophy.
- Consistent with the total study statistics, the corporate DP manager articulated the need for strong centralized control of both the system development and equipment procurement function.
- While somewhat extreme, the following approximate quote from a senior corporate DP executive is representative:

- "We control everything here. We buy the hardware, integrate it, maintain it, install it. We do the programming and can down-load any remote site from the host area by slaving it through the system."
- INPUT's impressions of the remote retail users are of individuals with extremely limited DP experience. By virtue of these characteristics, they appear ill equipped to meaningfully make hardware recommendations or operate semi-autonomous DP facilities. However, as users, they do have a valuable input to make on certain system performance and reporting features.
- Most of the retail MUEs interviewed operated with a strong centralized organizational structure exhibiting a classical hierarchical pattern, i.e.:
 - Consisted of individual retail stores operating within a geographical region or district and,
 - Reported to a group or division that was also geographically centered which in turn,
 - Reported to a senior corporate management functionary.
- Even those few decentralized operations that were encountered (where individual stores handled their own merchandising, order entry, inventories, etc.) retained a strong centralized DP function to support the larger corporate goals and operations.
- The degree of centralized control seemed to be the strongest at the smaller MUEs which were frequently family owned and managed.
 - DP sophistication within these establishments appeared somewhat below the GSD-2 levels with a perceived reduced level of importance in the operations of the company.

- Probably as a result of both the strong centralized control philosophy in conjunction with family ownership, more top executive level management participated in the decision to adopt a DDP type of system.
- However, it must be emphasized again that DP management respondents reported numbers of cases where current family owners had experienced poor earlier experience with data processing. Consequently they were reluctant to elevate the DP function to a higher level of importance within their businesses.

(3) Current And Anticipated Application Structures

- Amongst the common business applications that were reported, inventory accounting and control, payroll and labor distribution, general ledger and accounts payable functions predominated.
- Applications structures were almost exclusively limited to business data processing.
- Actual and projected applications functions to be performed by the DDP system closely paralleled existing DP functions with very limited evidence of expanded applications occasioned by the DDP system.
- Almost half of the retail host respondents mentioned some sort of tie-in of the host intelligence with other systems. However, there was a singular lack of sensitivity in interpreting this question to mean tieing-in with word processing or remote order entry applications.
- Those respondents who answered in the affirmative were largely relating to the addition of more traditional DP functions/systems that were not currently being performed; e.g., inventory control as opposed to word processing or expanded billing operations as opposed to adding process control or electronic mail functions.

- No particular differences between host and remote applications requirements surfaced as a result of the limited number of remote interviews that were performed. However, the more thoughtful respondents placed a great deal of emphasis on the time value of inventory, pricing and product sales trend information.
- The ability to replenish stores with fast moving merchandise or rapidly change prices in response to competitive pressures were key applications requirements. These seemed to be deeply ingrained management tactics that were being employed to sustain rapid growth and increase market share.
- INPUT perceived a strong desire on the part of the larger DDP respondents to write their own applications software and in so doing better tailor these programs to their own perceived market and management requirements.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- By far the single most mentioned reason for going to a DDP operating system was to improve the timeliness of information reporting. This response is probably also closely related to the reported "inefficiencies of a centralized system."
- Although "off-loading the mainframe" was not specifically mentioned within retail in response to question 34, it clearly was an important ancillary issue within the GSD-2 sample. A number of these respondents were indeed faced with varying degrees of capacity restraints.
- Specific positive factors mentioned for DDP included expectations for increased:
 - Cost/performance capabilities.
 - End user involvement and accessibility.
 - Timeliness of information reporting.

- The above is fully consistent within general industry comments. See Exhibits III-5 and III-6 for representative comments relating to the justification for DDP as well as some articulated positive factors.
- Alternately, negative DDP factors included concerns over:
 - A loss of control.
 - Possible end user inability to adapt to DDP.
 - Greater remote support requirements in both training and maintenance.
- See Exhibit III-7 for some representative negative comments.
- It was not possible to discern any correlation in retail with regard to IBM's perceived presence or lack of some in the DDP market and a respondent's propensity to adopt a DDP solution.
- A more critical issue for the respondents was identifying a set of operational requirements which were subsequently judged to be best met by a DDP approach. Hardware selection was then predicated upon what was available in the market with due consideration for IBM's products or lack of same.
- Internal data processing analyses, coupled with the evolving demands of the business, most frequently dictated a move toward DDP within the retail sector. Senior management involvement in the decision process was mandatory.
- Although cost/benefit analyses or trade-offs were frequently cited as the principal justification for going to DDP, INPUT believes that a limited amount of hard financial analyses were conducted to support the DDP decision. It is INPUT's perspective that, in most cases, anticipated operating benefits were the principal justification.

EXHIBIT III-5

COMMENTS RELATING TO DDP JUSTIFICATION IN RETAILING

- "Thousands of people staff our warehouses. We can't afford to have them standing around."
- "The company is going through a growth phase and we have to do away with tub files of purchase orders handled manually."
- "Performed a feasibility study which yielded a very conversative 2-1/2 year payback. It's worth the business risk."
- "A cost/benefit and ROI set of analyses were performed but basically it was corporate's desire to get the division under control."
- "Inventory levels are getting out of hand plus the fact that four key decisions have to be made at our cash registers. This is just to complicated a set of determinations for an operator to perform manually."
- "Part of the company plan was to develop an effective distributive system as a sales planning tool for the salesman/customer interface. "

EXHIBIT III-6

COMMENTS RELATING TO POSITIVE DDP FACTORS IN RETAILING

- "It's less expensive."
- "Having people who know most about the application doing the processing."
- "Cheaper when compared with the upgrading of the host and increasing data transmission costs."
- "It offers improved status for remote staff who are also hence forth more qualified to participate in trouble shooting and system development."

EXHIBIT III-7

NEGATIVE FACTORS OF DDP MENTIONED IN RETAILING

- "It costs more due to added equipment and communications requirements."
- "Justifying the cost benefits of a DDP implementation to senior management is difficult."
- "Conversion is tricky and difficult."
- "I don't have that much control or expertise at the remote site."
- "It's difficult to maintain distributed software. We'd like a software vendor to be available at our area offices and plants."
- "Minicomputer operating systems are of low quality."

- In those limited cases where true remote sites were actually operative, insufficient data existed to substantiate any claims regarding cost improvement benefits.
- Due to difficulty encountered during the study in finding qualified retail DDP respondents in the GSD-I range, additional emphasis was placed on telephone contacts in this enterpriserange. It is interesting (although not surprising) to note a greater incidence of less experienced DP personnel in the non-DDP respondent category with a relatively high incidence of no DDP experience at all.
- There seemed to be no single dominant reason as to why DDP was not being considered in small retailing establishments. However, it is INPUT's thesis that this resulted from a combination of factors that were not directly dealt with during the study but included:
 - A basic ignorance of the DDP concept and its potential benefits which is aggravated by a singular lack of a coordinated product/market strategy on the part of vendors and,
 - The high priority assigned to the daily demands of running small family owned businesses without too much apparent regard for longer term DP requirements.
- Based on the limited sample, the availability of applications software was not reported to be a major positive factor in potentially adopting DDP. This seemed to be consistent with widespread use of in-house applications software where most respondents felt that packaged solutions would not satisfy their own specific software requirements.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Although respondents offered a scattered number of answers regarding their DDP communications concerns, about 50% expressed dissatisfaction with reliability, maintenance and cost.

- One retail chain reported frequent difficulties due to storms requiring stores to go down while another chain endeavored to minimize communications usage because of error rate problems attributed to telephone equipment.
- It is interesting to note that AT&T was, with some frequency, mentioned as an inhibiting influence on the growth and acceptance of DDP.
- See Exhibit III-8 for representative comments on communications concerns.
- Approximately an equal number of respondents planned on distributing relevant portions of a data base (actually files) as did not.
- The issues surrounding distribution of data bases in retailing seemed to focus on the following:
 - Management style as evidenced by whether management would provide or withhold the necessary tools to operate local stores or distribution centers semi-autonomously or not.
 - Some lack of user sophistication and knowledge regarding the pros and cons of DBMS utilization and,
 - The potential impact of state legislation requiring the maintenance and availability of patient profile information and prescription records in retail drug operations.
- No particular surprises were evidenced as respondents provided information projecting a growing trend over the next four years toward interactive communications within local remote sites.
- Very little sensitivity appeared evident in most of the smaller retail interviews regarding the implications of satellite, VAN or network communications trends.

EXHIBIT III-8

SAMPLED COMMENTS REGARDING COMMUNICATIONS CONCERNS IN RETAILING

- "Lack of knowledge on my part. I'm scared of the subject."
- "We don't want to hire a team of systems programmers to set up a communications system."
- "I don't have any concerns."
- "Communications costs are so high we will probably put another computer in a smaller warehouse rather than tie it to another warehouse computer."

- A majority of retail respondents believed they could continue to operate effectively from 16-48 hours with an interruption in host and remote communications. However, limited importance should be attached to this dubious statistic in light of the limited operational record to date of DDP in retailing, particularly at the GSD-I level.
- Back-up systems principally include returning to manual methods or resorting to a cooperative host arrangement with another business having a similarly configured host.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- The most important factors in selecting a DP (or DDP) vendor were consistently reported to be reliability and service with some lesser concern over the ease of software use.
- Unlike other industry sectors, there seemed to be less concern over the cost or performance capabilities with a number of respondents believing that there were very limited performance differences in most available hardware.
- Availability of a cooperative host (or possibly a remote) arrangement, mentioned in the previous section, seemed to be an important part of the reliability issue.
- The four most important factors that retail respondents cited when considering a DDP vendor included:
 - Product reliability.
 - Maintenance capability.
 - Software compatibility.
 - Hardware compatibility.

- These responses were fully consistent with industry wide statistics.
- It is also interesting to note that the availability of applications software and the "one stop shopping" concept ranked very low. This is fully consistent with 11 of the 12 host respondents reporting that the in-house staff represented a principal source for applications software. However, of the three on-site non-DDP respondents interviewed (all of whom were small companies with limited DP departments), the availability of applications software was regarded as a relatively important factor.
- Computer and communications hardware and software maintenance is principally handled by the vendor with users retaining control and updating their own applications software.
- The experience and satisfaction to date of those retail firms actually having some DDP operating experience was reported to be quite good. However, it is INPUT's contention that it is still very early in the DDP concept's existence for creditability to have been firmly bridged in retailing.
- Two representative comments from retail DDP users follow:
 - "Outstanding - margins have improved by 1-1/2%, data error rates are substantially down below 2% from 50% levels before and each store now receives daily margin reports rather than having to wait 8 days."
 - "Still too much involvement of DP staff in user operation."
- The most frequently mentioned company in retailing regarded as influential in promoting the success of DDP was Digital Equipment Corporation followed closely by IBM. The usual array of minicomputer companies were also mentioned and included Hewlett Packard and Data General as well as Datapoint.
- Many of the retailing respondents named IBM as recent supporters of DDP by virtue of Series/1 and to a lesser degree System 34 product introductions.

- See Exhibit III-9 for some representative comments.
- IBM was also singled out as the company most influential in inhibiting the growth of DDP. These comments were usually directed at historical perspectives and appeared to be focused largely at DPD activities.
- Some comments were made about the lack of a viable product family from IBM to support the DDP concept.
- See Exhibit III-10 for representative comments.
- Remote site users were particularly ill-informed about the competitive DDP environment and had difficulty in discussing vendors that were supportive or not of the DDP concept.

(7) The Future For Remote And Host Participants

- The most important set of criteria for the success or failure of DDP in retailing centered on the involvement of the end user in the planning, design and implementation of the system. Emphasis was placed on having senior management's on-going involvement and support.
- However, INPUT believes that all of the above in retailing will be implemented through strong centralized control and procurement.
- End users lacked meaningful DP experience and expertise and are particularly ill-suited to contribute solutions or recommendations to technical problems. Accordingly, efforts to offer hardware and software products that come as close to being "technically transparent" as may be feasible appears useful.
- Although a marketing strategy that includes some sales effort at the end user level may have merit, the corporate or divisional DP center, in conjunction with senior operating management, remains the focal point for the selling and implementation of the DDP concept.

EXHIBIT III-9

REPRESENTATIVE COMMENTS REGARDING VENDORS INFLUENTIAL IN DEVELOPING DDP

- "HP - their equipment communicates with IBM hosts and has proven software/hardware capability. It can be serviced in the field. We also expect the company to be in business for a long time and provide upgrades."
- "IBM - has more influence on what will happen - now catching up - deciding to get into the act and sanction it (DDP). IBM holds the power. They've been forced to get into the minicomputer business."
- "DEC - we have their products."
- "IBM - you can't get by without looking at them or it will come back to haunt you."
- "None - we haven't been able to get what we want from vendors so we have done it ourselves."

EXHIBIT III-10

REPRESENTATIVE COMMENTS REGARDING VENDORS LEAST INFLUENTIAL IN DEVELOPING DDP

- "AT&T - They're using non-standard communications equipment within their system which is sometimes noisy, old, obsolete. How do you talk to the other operating companies in the system?"
- "IBM - stressed extremely costly ventures with large communications and hardware costs."
- "IBM - but now changing. They could have made DDP years ago."
- "All mainframe companies who make their money on selling big central systems and subsequently getting people to upgrade."
- "The phone company and IBM have not been responsive to our troubles. Maybe SDLC will do away with these difficulties."
- "NCR - we have to pay \$6,000 for an ECR but it doesn't help in inventory control."

- The issues surrounding the lack of DDP standardization in retailing have not prevented select companies from implementing such systems as most of the comments in Exhibit III-11 suggest.
- Alternately, greater software/hardware compatibility is viewed as clearly increasing the move toward DDP systems. Refer to Exhibit III-12 for related comments.
- Although retailing appears to be one of the least attractive markets today for DDP, the concepts acceptance could accelerate rapidly as a function of:
 - Increased DDP standardization.
 - A coordinated product/market vendor strategy.
 - Regulatory action.
 - Acceleration in the retail acceptance of POS.
 - Increased competitive pressures occasioned by those companies who do adopt DDP.
- Exhibit III-13 offers comments related to the future success of DDP in retailing.
- Adoption of a DDP implementation will be greatly enhanced if a more concrete case can be made for improved asset management; e.g., inventory control and turnover or enhanced profitability through cost reductions.

EXHIBIT III-11

COMMENTS RELATED TO THE LACK OF DDP STANDARDIZATION IN RETAILING

- "Don't think standardization in EDP or DDP is possible. We will tailor our system to suit ourselves."
- "Really painful - now locked into Hewlett Packard - no real chance to go elsewhere."
- "We can't keep track of all the equipment on the market. I don't have the staff to do market research and benchmarking."
- "No impact - we feel we can buy the minis and micros we want and tie them together."

EXHIBIT III-12

COMMENTS RELATED TO INCREASED HARDWARE/SOFTWARE COMPATIBILITY IN RETAILING

- "Hardware is so far ahead of software it isn't funny! Vendors better catch up on software. Software is not tailored to my applications."
- "The issue becomes academic once you've selected a particular vendor."
- "All mini manufacturers say they will have SDLC."
- "We are looking to do more leasing as a result of technical uncertainties and increased corporate merger and acquisition activity."
- "Not a real problem so far. It may become one as we get deeper into it."

EXHIBIT III-13

COMMENTS RELATED TO THE FUTURE SUCCESS OF DDP IN RETAILING

- "We need a machine that can withstand the store environment."
- "We need consumer acceptance of word processing and OCR A coding."
- "We need more standardization of product codes."
- "Attitudes of key personnel must be supportive of the concept."
- "System must be highly flexible because the consumer changes preferences on a dime."
- "User training - POS results are poor due to poor human factors and inadequate operator training."
- "User satisfaction."
- "Controls . . . such that accurate data is returned from remote sites with unsophisticated users at the remote site. We don't want experienced (DP) personnel at remote sites."
- "Will the promised savings in labor intensive areas be realized or will Parkinson's Law prevail in DDP?"

3. PROCESS MANUFACTURING

a. Overview And Conclusions

- Although the DDP concept is broadly understood in process manufacturing, actual experience is very scarce in small companies and marginal in large companies; i.e., most of the actual systems are of a threshold nature in which only limited programmable intelligence is installed at the remote site. The bulk of applications processing still occurs at the host site.
- DDP applications differ little from those run on a conventional batch or on-line basis although there is a discernible tendency toward source data applications. Technical computer usage (e.g., process control) and office computers (e.g., word processing) are not yet seen as potential nodes in a DDP network.
- The process industry (as with other industry segments) is at a very early stage in the evolution of DDP systems. No respondent has a system overview which suggest that an examination of a comprehensive DDP system has been conducted. Even if such an analysis had been completed it would be based on some very fundamental concepts that would, for example, not include distributed data bases. Above all there are few, if any, fully justified and operationally proven DDP systems in this industry.
- Perhaps the greatest shortcoming in appreciating the potential of DDP is that it is not seen as an organizational or management concept.
- Remote site managers are strongly in favor of DDP because of the independence and local control it gives them. Conversely, computer (host) management is worried because control of a DDP network is much more difficult with increasing user involvement and there is fear of a loss in control. No computer manager reported visualizing any change in his department's role as DDP systems become more pervasive.

- A by-product of these two perspectives is that remote site management has a need for application packages that require minimum computer expertise to set up and operate. Host computer management sees itself continuing to develop systems along traditional lines.
- The process industry needs better insight into the rationale and economical advantages of DDP as it applies to their industry. In parallel, DP managers need to be reassured that DDP still affords them a major role in the future of data processing.
- There may be more opportunities for hardware and software products that are process industry specific as opposed to general purpose. An example of this could be production monitoring software which interfaces with a control process or a production control system.
- A marketing approach must be developed which can accommodate the needs and changing roles of computer and remote site managers without conflict.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- The remote site is defined by process manufacturing respondents as being located separately from the main (host) computer installation at a departmental, plant or branch location within the same building or on a more distant site.
- The defined equipment installed for decentralized processing at the remote site ranges from intelligent terminals with application data processing capability to full minicomputer configurations. (Other manufacturing industries defined the lower limit of equipment as a minicomputer.)
- The purpose of the remote site equipment is to serve local needs and to be as close to the end user as possible.

- The functions of the remote site equipment are seen to be data entry, inquiry and complete applications data processing using both local and host files. (One respondent referred to a distributed data base in this context.)
- The achievement of local operating autonomy was included in the DDP definition by some respondents. In one case it represented "processing power and responsibility for newly acquired companies."
- The host site is defined as the traditional location of a mainframe which in a DDP system carries out the additional tasks of:
 - Summarization of detailed output procedures at remote sites.
 - Maintenance of large or common application data files.
 - Coordination of data files and output at remote sites.
 - Control of the communication network.
- Some DDP respondents didn't have a definition, probably due to the evolution of a distributed system structure to meet specific needs without classifying the result with the conventional label "DDP."
- A total of 28 respondents were interviewed long enough to determine their DDP status. About 25% claimed to be involved with DDP but unwilling to provide complete information.
- One-third were non-DDP respondents with half of these providing reasonable DDP definitions. The remainder were in the "don't know" category (small organizations of less than 850 employees).

- Approximately 60 enterprises were contacted resulting in the above 28 respondents. A strong impression gained from this experience is that industry inertia is largely due to uncertainty and ignorance of the subject - professional people (i.e., those approached) are usually unwilling to answer questions about a subject with which they are not familiar. This applies particularly to corporations with less than 1,000 employees.
- As expected, respondents in large organizations were well informed about DDP. More than 80% of all respondents in both large and small corporations had more than 10 years experience in EDP. However, they are still less experienced than their counterparts in the other manufacturing industries.
- More than 60% of non-DDP respondents claimed to have minimal or no DDP implementation or operating experience. One hundred percent of the SUE respondents claimed to have minimal or no DDP experience.
- To summarize, although the term DDP is quite well understood in broad principle, little in-depth knowledge resulting from "hands on" experience exists in the process manufacturing industry - only the largest companies proved to be the only exception in this respect.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- In decentralized process manufacturing corporations, DDP systems map quite closely the management structure and its balance between centralized and decentralized functions.
- Functions which benefit from a centralized approach are retained at the headquarters location, e.g., financial planning, market strategy, large capital investment decisions, corporate accounts and some procurement.

- Most process manufacturing corporations have plants and offices which are geographically widely distributed. In such cases, a decentralized management style (in some cases semi-autonomous) and a DDP approach are the obvious practical solution. In SUE's, however, this argument does not hold and DDP is a less natural solution.
- Decentralized plants and offices in the large process manufacturing corporations tend to have control of computer planning and operation. Reference to the corporate data processing office is done only for technical advice, procurement approval and for development and operating standards. The approaches expressed by management at remote plant and office locations emphasizes their desire for increasing independence and self-sufficiency. One went so far as to insist that (an accounts manager) would hire programmers, develop systems and operate them independently of the host. However, he admitted that he would not be allowed to sever the data link for corporate control reasons!
- An advanced degree of independence has already been achieved or is in sight for many remote sites since the availability of back-up in the event of power failure is not critical.
- In one large organization, the DDP issue appears to have renewed the management "tug of war" over increasing headquarters versus local control!
- The DDP approach was found to be an effective tool for establishing control over newly acquired companies.
- In smaller and particularly family owned and managed corporations, the management style is centralized and relatively autocratic. The adoption of DDP is therefore limited to pre-processing functions such as data entry, edit, and file update and inquiry. In some cases this may be interpreted as a cautious step in the direction of fuller DDP after achieving user confidence and reducing corporate fears over the loss of control.

- Some non-DDP respondents felt that the family management's resistance to change exceeded the strength of any case for DDP which they could present!

(3) Current And Anticipated Application Structures

- In the process industry, the predominant current primary applications are in the accounting area - this is in complete contrast with the oil, automobile and aerospace manufacturing sectors which tend toward more technical applications. Inventory control and order entry are the next most primary applications with inventory covering finished goods, inter-process stock and maintenance parts. The primary applications in this industry in descending order were:
 - Accounts receivable.
 - Inventory control (various).
 - Order entry.
 - Accounts payable.
 - General ledger.
 - Payroll.
- This pattern is reflected at remote sites which, in addition, tend rather more to such production related applications as:
 - Payroll.
 - Job costing.
 - Engineering and production data.
 - Material requirement planning.

- Currently, however, these applications are run on a host dependent basis with planned emphasis on more extensive local processing against remote files.
- Less than 10% of corporations in the process manufacturing sector have any tie-ins with event driven or work oriented computer systems. Those recorded have the status of "decentralized" rather than "distributed" systems. In comparison, there are more tie-ins in the process sector and far fewer than those in the oil industry.
- Sixty percent of remote sites are engaged in limited pre-processing or "threshold DDP." Twenty-five percent are fully self-sufficient, the balance of 15% combining pre-processing with some standalone local applications processing. In comparison with other manufacturing industries, the emphasis is greatly loaded in favor of "threshold DDP."
- The ratio of planned to actual remote DDP sites is much smaller than in the other manufacturing industries, indicating a relatively small potential for DDP expansion.
- No discernible difference exists between future applications for DDP and the current primary applications. (This applies to the oil and aero/auto sectors also.)
- Over half of the respondents would buy applications software from an external source. Those that do not plan to do this hold the view that an uneconomic amount of work is involved in applying an application package to their business which results in a less efficient system anyway. For distributed minis with relatively limited facilities there is clearly a need for a more cost effective approach to developing applications software.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The predominant motivation for adopting a DDP approach in the process industries is to achieve better service for the user in terms of more accurate information that is provided more quickly. One respondent expressed this as "information at users' fingertips."
- The other positive factors in favor of a DDP approach are improved cost/performance compared with other data processing methods and the reduction of relatively expensive mainframe usage.
- Other reasons for adopting DDP are:
 - Lower data transmission cost.
 - More practical as a means of serving specific needs.
 - Ensures continuity of standard procedures independent of individuals.
 - Ease of system expansion.
 - Increased reliability and availability.
- Remote site managers reflected the user service and cost/performance reasons but with emphasis on independent control over his specific area of responsibility or as one respondent put it "control over my own destiny."
- On the negative side, data processing executives are uncomfortable about:
 - Potential loss of control to remote sites resulting, for example, in uncoordinated development of the DDP network and systems with consequent degradation and loss of cost/performance.

- Increase in complexity of equipment and software combination and decreasing direct knowledge of their performance as they're distributed.
 - The increased cost and difficulties connected with maintenance and training due to increased complexity and distribution.
 - Involuntary planned obsolescence due to rapid changes in technology.
- Negative factors were comparatively rare at remote sites with the main concern being that they were still vulnerable to the unreliability of the host site!
 - In all cases the adoption of a DDP approach has evolved from the natural process of choosing computer equipment and configuring it to meet a specific need. In most situations, decision making was through the conventional data processing department proposal followed by the executive (individual or committee) approval route. Users are generally consulted but have little say in the final selection of equipment.
 - The majority of process corporations report using cost/benefit techniques to justify new data processing projects but few of these are particularly thorough; other respondents justify on the basis of cost and adequacy for the task of alternatives (including incremental expansion of the mainframe).
 - All non-DDP respondents from small companies (less than 850 employees) considered themselves too small to benefit from DDP. The large non-DDP corporations (more than 10,000 employees) felt that their present systems were entirely adequate.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Over half of respondents in the process industries are planning to have (or have already) distributed data bases. They are taking this approach in order to realize the benefits of DDP for the remote user in applications such as inventory management and order entry. Typically, a portion of the data base

will be held at the remote site representing the records required locally; at frequencies varying between daily and two or three times monthly the remote file updates the host file. A distinct need for proven distributed data base management software was observed. This is a fundamental requirement due to the rather primitive approach being taken.

- The data base management system required is one which will with minimum communications cost make user data readily available to him. This, for example, will entail holding the most active (20%) inventory records on the remote machine and sending any other down the line as required. Such a system must be transparent to the user and is an increasingly important function for the host site.
- Operations involving a distributed data base will depend very heavily on the availability of high grade low(er) cost data communications facilities. This concern was voiced by many respondents. In addition there are concerns about the methodology for DDP network design and management.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- As with all manufacturing industries, the process industry select a DDP vendor above all because he can provide in descending order of priority:
 - Product reliability.
 - Maintenance capability.
 - Ease of training and use.
 - Price/performance.
 - Vendor image and viability.

- Both host and remote site managers are consistent in this appraisal of vendor selection criteria.
- Discounts and special terms and conditions were not rated highly at all although some respondents like to have a "buy back" clause in their agreements for purchased equipment.
- A significant proportion of respondents in this industry did voluntarily specify that the vendor's product plans should support comprehensive growth of their systems.
- Applications software supplied from the vendor or any other external source has a very low priority in the process industry. An overwhelming majority prefer to write their own software. Only one specifically mentioned the desirability of applications software available on a turnkey basis which would be compatible with his other systems.
- In terms of technical requirements, and again like the other manufacturing corporations, compatibility of both hardware and software was considered very important.
- Language availability was also considered very important (more so than for the other manufacturing industries). In this case COBOL, BASIC, and RPG being the most desired. Surprisingly, PL/I was not mentioned by any respondent.

(7) The Future For Remote And Host Participants

- In the process industries the user is considered the center of attention when planning ahead. It is widely believed that users must be deeply involved in the evolution of DDP systems and be of sufficient calibre and have the minimum training in order to participate effectively. Commitment of users to DDP will be sustained by systems which meet their needs, are easy to operate, are reliable and have the flexibility to grow without disruption to normal business operations.

- Many respondents believe that systems structure planning and management is an important key to DDP future success. This coordinates with the earlier needs inferred for DDP network planning/simulation aids and distributed data base methodology/products.
- Some respondents feel that the cost/benefit argument has to be persuasive in order to enable DDP to succeed. A contributing aspect of this that was also mentioned is the achievement of "reasonable" hardware and line costs.
- Process industries feel that increasing compatibility of software and hardware and the present lack of DDP standardization will have the greatest impact (positive and negative respectively) on the future of DDP systems.
- More than one-third of respondents considered that increase of automation in the office will have a major impact on their future DDP systems. The majority felt that this impact would increase with time.
- The "user" who is synonymous with operating department divisions, plants or branches, will in the future pay the DDP expenses. This is consistent with increasing responsibility for computer systems development and operations in order to fulfill more directly all delegated responsibilities.
- Most DDP systems have or will replace conventional batch processing (off-line) operations. In the future, it is anticipated that on-line systems will also be converted by interfacing remote minis between unintelligent terminals and their host. This will occur in order to increase the repertoire of user services and to enhance user services as the host performance becomes degraded by additional terminals.
- Current and future "first generation" DDP systems are and will be built primarily on star networks. Hierarchical as well as ring networks will increase as the degree of distribution and organization mapping increases. Data processing departments will evolve toward less emphasis on applications and rather more emphasis on:

- Management of the DDP network.
 - Technical consulting and training support for the user.
 - Selection and enforcement of systems development, network, hardware and operating standards.
 - If appropriate, to supply special or large scale computing facilities for linear programming, corporate distributed data bases, etc.
- Selling of DDP systems will in the longer term be effective at remote sites for application based products. This could be accelerated if such products were available on a turnkey basis and were demonstrably highly cost effective. Meanwhile, the central DP department is still the place to sell although the trend will be toward more specialized or dedicated (e.g., data base processors for total production and accounting data) hardware and software.

4. OIL/PETROLEUM

a. Overview And Conclusions

- DDP is much better understood in the oil industry than in most other segments and DDP systems experience amongst respondents is easier to find. Most examples are of a self-sufficient form of DDP in which many applications are completely processed at the remote site; indeed they were implemented before the term "DDP" was coined.
- DDP applications differ little from those run on a conventional batch or on-line basis and the switch to DDP is a matter of the degree of distribution desired. Some applications which are peculiar to the oil industry (seismic processing, refinery modeling, etc.) will remain relatively non-distributed until remote machines have sufficient power or are dedicated and highly cost effective for a single application.

- Such technical applications for computer systems as process control and pipeline monitoring are generally linked into other computer systems (within large corporations particularly) and this is in distinct contrast with other manufacturing industries. Word processing and other elements of office automation are not seen yet as potential DDP nodes.
- The shortage of DDP products worries the oil industry less than others. Distribution of data bases is easier due to data exclusivity and the industry allocates enough funds for tailoring to requirements. This approach does not preclude purchase of proprietary software products.
- DDP has partially evolved as a management concept within the petroleum industry, and DP delegation of job requirements has been an established practice. Only the cost/effectiveness has yet to be proven. This latter consideration is important to remote site managers.
- Computer management needs greater education on the changing role of the central data processing facility.
- The oil industry will buy cost/effective DDP products which are user oriented and quickly installed. Specific examples are:
 - A dedicated seismic processor; i.e., large class machines with remote site operational suitability and economics.
 - Back end processors for large remote data bases.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- Overall agreement exists among respondents that DDP means a distribution (and off-loading) of the central mainframe load to minicomputers at remote sites. Compared with the non-oil processing industries, this definition implies a "top down" view as opposed to defining the user "requirement as a motivator."

- The caveat expressed by host respondents is that the extent of data base distribution and power available to remote sites is limited.
- The viewpoint of the remote site tends toward a greater degree of distribution "for high quality/low cost achievement of local job objectives" and to get "minis doing large machine work on-site."
- The communications element is seen as a line data transmission link to make greater facilities available for the remote site.
- The oil industry respondents were very experienced in EDP (typically 15-25 years) and generally more experienced in DDP (typically 1-2 years).
- Thus, in the large corporations each telephone approach was productive. No respondents were unwilling to talk to INPUT and there were no non-DDP respondents.
- However, in the small corporations (less than 1,000 employees), the ratios of non-DDP respondents, DDP respondents unwilling to talk to us, and respondents ignorant of the DDP concept were similar to experience with organizations of this size in the process industries.
- Under these conditions INPUT was required to at least double the number of telephone attempts to achieve the targeted sample size.
- Nonetheless, the term DDP seems to be better understood than in other manufacturing sectors and the slightly greater degree of experience was noticeable in the better creditability of respondent answers.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- Oil corporations by the very natural distribution of their activities for exploration, production, refining, and marketing tend to be run along decentralized lines. The movement toward a DDP approach in such

organizations is an unremarkable and natural development in the use of computer systems which started even before the term was invented.

- Functions which will probably remain centralized due to better cost effectiveness are operations research, financial and investment planning, and corporate accounting. Data processing is also accepted as a continuing central function for specialized support of remote and headquarter users.
- Currently most remote sites are in transition from pre-processing to primary applications processing. This is evident because remote minis have not been big enough. One remote manager is making a play for the 370/165 they use at the central host site! In fact, the corporate plan is to upgrade them to a 370/165 in their development toward a hierarchical network.
- Like other manufacturing sectors which have experienced DDP, remote managers want to have more control through the use of DDP. Although they are desirous of achieving complete independence at the remote site, they recognize the need for continuing technical support from the host site.

(3) Current And Anticipated Application Structures

- Traditionally, the oil industry has always heavily invested in EDP for a wide range of applications. The primary application areas (in the exploration, production and refining segments) are currently in both the accounting and technical areas and include:
 - Accounts receivable.
 - Accounts payable (including royalties).
 - General ledger.
 - Inventory control (maintenance parts).

- Seismic processing.
- Refinery modeling.
- Tying in with the primary applications are two major applications in the production and refining activities, namely:
 - Process control.
 - Pipeline monitoring.
- The majority of oil corporations have other system tie-ins which is in complete contrast with the process and aero/auto sectors which have tie-ins in less than 10% of the sampled total.
- Threshold DDP sites hardly exist in the oil industry; i.e., sites are either self-sufficient (75% of the sample) or part pre-processing/part self-sufficient or "hybrid" (25% of the sample).
- Planned additional remote DDP sites are double the existing numbers indicating relatively good potential for development of DDP.
- The large corporations are by far the most active in both "hybrid" and "self-sufficient" DDP sites.
- No discernible difference exists between future applications for DDP and the current primary applications.
- The majority of respondents indicated that they would buy applications software from an external source to complement that produced in-house. Compared with the process and aero/auto sectors, the oil industry considers the availability of applications software to be more important.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- In common with other manufacturing industries, the Oil industry is predominately adopting the DDP approach to achieve better user service. In the oil industry this was expressed in terms of faster response and better data quality.
- A secondary reason is that mini-based systems are simpler to deal with and are more efficient compared with alternatives involving remote users using a conventional central computer facility. Remote users, in particular, want their computer resource locally so as to better control their data.
- On the negative side, data processing executives are uncomfortable about:
 - Potential loss of control to remote sites (large corporations).
 - Greater difficulties with maintenance and staff training due to system complexity.
 - Data base synchronization problems.
- Remote sites did not have any negative views!
- In all cases, the decision to go DDP was initiated by the data processing department with user involvement in defining the system requirements. The DDP "label" was added after the event. Generally, a proposal is submitted for approval to an executive committee which embodies the preferred equipment specification and the economic justification. Cost-benefit analysis is widely used and increases in detail and formality with the size of the investment.
- Non-DDP respondents were frequently small companies (less than 600 employees) which choose not to employ DDP because they claimed to be either too small and/or prefer centralized control.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- All respondents in the oil industry have, or are planning to distribute their data bases. The large corporations particularly, are decentralized in both management and geographic terms so that distributed data bases are appropriate. Distribution of data bases is relatively easy in this industry due to a high degree of functional and data exclusivity at remote sites. Thus, plans for distribution are probably more advanced than in the other manufacturing industries due to a limited requirement for improved distributed data base technology.
- Data communications requirements will be directed at high speed networks to transmit reports, file summaries and bulk application data (e.g., seismic) as apposed to transaction or interactive traffic. Interaction between different parts of a corporate distributed data base is a much smaller requirement compared with the other manufacturing industries.
- The main concern about DDP communications is the lack of standards and facilities for network management. Unlike other manufacturing industries, cost is not an obstacle. Neither is speed (the big oil corporations have microwave circuits) and quality.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- As with other manufacturing industries, the oil industry selects a DDP vendor because it can provide in descending order of priority:
 - Product reliability.
 - Maintenance capability.
 - Ease of training and use.
 - Price/performance.

- Vendor image and viability.

- Both host and remote site managers are consistent in this appraisal. They also both agreed that discounts and special terms and conditions are relatively unimportant.
- Unlike the process and aero/auto industries, the oil industry is interested in vendor offerings of applications software. Indeed this was at the top of the list of technical requirements along with hardware and software compatibility.
- Language availability was the next most desirable technical requirement; the oil industry likes to have available COBOL, Assembler, RPG and PL/I.

(7) The Future For Remote And Host Participants

- Less concern exists in the oil industry for the user. The general feeling is that he's already either a sophisticated computer user or his technical capabilities and traditional self-sufficiency will pull him through.
- Fast implementation is the strongest criteria for success in DDP and is closely followed by good cost/performance since this relates directly to the achievement of local responsibilities.
- The oil industries traditionally have plenty of money to invest and expenditures on data processing relatively trivial compared with an Alaska pipeline or super tanker. Consequently, relatively less inertia exists for new ideas such as office automation. This aspect of DDP is expected to create the greatest impact on DDP systems of the future.
- Also, not surprisingly for the oil industry, communications trends and increasing hardware/software compatibility will make a significant impact. The lack of DDP standards doesn't worry them particularly since its a problem they feel can be solved internally.

- Like other manufacturing industries, the end user/remote plant, branch or division will pay the DDP expenses.
- Most DDP systems have, or will replace, traditional off-line batch processing operations.
- In common with other manufacturing industries, the oil industry has, or will have, star networks as a DDP first generation architecture. There is already evidence that hierarchical structures will evolve in line with delegated operational responsibility particularly in the large oil corporations.
- The evolution of data processing departments toward increasing technical, functional and support activities, as already described, applies equally to the oil industry. The remarks about DDP selling apply equally well also!

5. AERO/AUTO VEHICLES

a. Overview And Conclusions

- DDP is broadly understood but is being implemented only by the large corporations and small companies are in the planning process. Extreme cost consciousness of the latter is no doubt due to their relationship as sub-contractors to the "Big Three." However, therein lies some of the (unrecognized) opportunity for future DDP systems.
- No difference in respondent profiles is noticeable between non-DDP and actual or intended DDP systems. Any functional tie-in within a DDP system of NC machine control, automated warehouses or automated offices has not been encountered.
- Some of the small companies interviewed have computer to computer communications for order scheduling providing unrecognized opportunities for linking order processing with progress reporting, shipping and accounts receivable in a DDP system. The opportunities for customer billing through the same link is also not recognized.
- Unlike the large corporation, small companies do not perceive DDP as an organizational concept. The prospects for a rapid expansion in DDP systems amongst small companies is promising.
- In an industry so seemingly interdependent as aero/auto, the availability of standards should encourage movement toward DDP.
- Already, conflicts are arising in the market due to apparently uncoordinated approaches by DPD and GSD salesmen. The rate at which different components of the same DDP system are being offered by different salesmen from the same vendor is increasing. This is inevitable as office, data processing and technical computing become integrated. This trend in vendor visibility will require some radical adjustment in vendor sales organizations.

- DDP products specifically developed for shop floor operations would be very welcome; but only if they are priced at a level that is easily perceived to be beneficial from a cost/performance view.
- The aero/auto industry has a huge potential for DDP but substantial inertia exists at the plant level and the educational, product development and marketing efforts required will be enormous.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market

- Remote/distributed computing is perceived by respondents as a decentralized or departmental activity which is convenient for users.
- The remote computer is defined exclusively as a mini (i.e., no reference to intelligent terminals) configuration with adequate processing and file capacity to permit an adequate local service.
- The communication link is seen as a line connection which is transparent to the remote user when accessing host files or interacting with the host in any other way.
- The host machine is defined as much larger than the remote(s) and fulfilling, specifically, the function of centralized network control.
- As practioners of EDP, the respondents in this industry are very experienced. All but one of the eight host respondents had more than 10 years experience, with most of them being in the 15 to 25 year bracket.
- Experience in gaining the target sample was identical with that encountered in the Oil industry where the data processing management were similarly very experienced in EDP.

- Inertia was encountered in the small corporations where they are still in the early planning stages for DDP systems and seem to feel unequal to the task of answering a comprehensive set of DDP related questions.
- In terms of implementing DDP, the industry has up to 2 years experience in small companies with less than 1,000 employees and between 2 years and 10 years of experience in the large corporations.
- Overall, 50% of the respondents had less than 1 year experience or none at all. (This makes them significantly less experienced than their counterparts in the oil industry and marginally more experienced than their counterparts in the process industries.)

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- The large auto/aero manufacturers are experienced and sophisticated in their decentralized management structure. Plants and offices are widely disbursed with each being substantial in its justification for local computer power.
- Hence, DDP is a natural evolution for such organizations that want control over a network of departments and profit centers with each node being expected to make use of the best aids available to enable them to do the best job.
- In such large corporations, the central data processing function carries less weight and survives and contributes only in proportion to what they can offer to plant and office managers. Support is still requested in the form of equipment procurement and standards.
- Smaller corporations, particularly in the auto industry, are extremely cost conscious. Consequently, management thinking is opposed to instituting comprehensive changes in the data processing area which may not yield tangible short term benefits. Thus, the data processing department is relatively powerless compared with the user (revenue earning) departments and plants.

- Central data processing functions therefore lack power in both large and small corporations, but for different reasons.
- Also, the smaller corporations are often autocratically run by the founder or family management which displays the usual tendency to keep rigid control.

(3) Current And Anticipated Application Structures

- Due to the relative complexity of operations in the aero/auto industries, primary applications tend to be more concentrated in the inventory and production management area, although there is still considerable development required. Accounting applications are obviously a necessity and therefore also appear on the following list of primary applications:
 - Inventory control.
 - Sales analysis.
 - Payroll/labor distribution.
 - Bill of materials.
 - Engineering and production data.
 - Materials requirements planning.
 - Shop scheduling.
- In the large aero/auto corporation, remote sites are self-sufficient for maintaining applications for which the local management has complete responsibility. These include commercial applications such as purchase order entry, vendor analysis, etc. Technical applications tend to be processed through timesharing networks.

- There is relatively little current DDP activity in small auto corporations (less than 1,000 employees) and plans are barely formulated and unambitious. Even the preliminary "threshold" sites are almost totally absent.
- No discernible difference exists between future applications for DDP and the current primary applications.
- Few respondents rated the availability of applications software as important or that they would be prepared to purchase software from an external source. This opinion relates mainly to a shortage of cost effective applications software at the shop floor level of operations. (Acceptance by union is an additional factor!) Surprisingly, remote sites were less concerned about ready-made software.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The aero/auto industry is motivated in the direction of DDP in order to serve operational and business needs by supplying the user with a better management tool.
- Independent control for the user over his specific area of responsibility is also an important factor and user acceptance is good. In larger corporations it is believed that DDP distributes risks resulting from catastrophies; e.g., fire, earthquake, etc.
- Cost is a controversial subject since some aero/auto corporations believe that costs are reduced overall by DDP. However, others believe that due to additional (distributed) data base storage requirements, more communications equipment, more staff and additional hardware, costs are required.
- Other negative views expressed by respondents included:
 - Loss of control to remote sites.

- Inadequate standards for DDP systems development and operation.
- Substantial training costs.
- Non-DDP respondents were mainly companies with less than 650 employees who believe that they are either too small to benefit from DDP or their management style is too centralized.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Less than half of the aero/auto corporations have or will be distributing their data bases. This applies to both large and small corporations. The resistance to distribution of the data bases appears to be higher than in any other manufacturing industry and can be accounted for by:
 - The greater potential for node interaction distribution to remote sites, coupled with the lack of proven software technology or facilities which would allow cost/effective and reliable distribution to be implemented.
- In those corporations which have or are contemplating data base distribution, the predominant technique is to duplicate the host master at remote sites either in part or in summary for such applications as material control and shipping documentation.
- Updating occurs by refreshing from the current remote file or updating the host data base which in turn refreshes the remote file. These methods are primitive since they apply very traditional techniques to what is eventually an advanced systems requirement.
- Once again (particularly in the process industries), there is a distinct need for a proven distributed data base system which will minimize communication costs and enable all users to have acceptable response time for retrieval of the data they require.

- A further aspect of this requirement was described by one auto parts manufacturer as a need to split the inventory file according to the 80/20 rule. That is, the most active portion (20%) of the file would be at the remote site, thereby necessitating access to the host for relatively inactive records. This type of arrangement would seem to satisfy some of the potential concerns in the area of storage and communications trade-offs.
- Host dependency, and therefore availability of the host/remote data link, is generally non-critical and ranges from 1-3 days. There were two examples, however, requiring that interruption last no longer than 3-4 hours.
- In the first case, the distribution of the data base could be said to be "static," that is that the remote parts of the distributed data base are sufficient to enable remote independence.
- The more critical areas, which could be said to be "dynamic," support a rather high degree of inter-dependence between host and remote parts of the distributed data base and of the overall application processing. The "dynamic" cases are those requiring a distributed data base system with an optimizing capability and transparency for remote users as soon as it can be made available.
- A further requirement referenced by some respondents was the need for a system development tool which would enable the performance of a distributed network to be predicted/simulated in advance.
- The predominant concern about DDP communications is the risk of lost or low quality data, particularly in the dynamic data base and processing illustration.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- As with other manufacturing industries, the aero/auto industry selects a DDP vendor because he can provide in descending order of priority:

- Product reliability.
 - Maintenance capability.
 - Ease of training and use.
 - Price/performance.
 - Vendor image and viability.
- Both host and remote site managers are consistent on this appraisal. They also agreed that discounts and special terms and conditions are relatively unimportant issues.
 - Availability of applications software gets a middle rating in the aero/auto industry from the remote sites but a low rating from the hosts. Remote sites are not bound by tradition and with their new found data processing independence, they are more open to considering the use of vendor applications software.
 - Some respondents were very positive in identifying the need for shop floor control systems, if possible, on a turnkey basis for such things as time/operation recording and order tracking. Indeed it was felt that they should be distributed and delegated as specific shop floor management responsibilities.
 - Product line growth to cover all future systems expansion is important in insuring that the vendor will remain in the computer business.
 - In the highly cost conscious aero/auto industry, a firm impression was given that the operating departments and divisions were likely to be more successful than central DDP management in the justification of distributed computer sites.

- As in other manufacturing industries there is a strong preference for hardware and software compatibility. Almost as important is good language availability; those required being predominantly COBOL, FORTRAN and PL/I.

(7) The Future For Remote And Host Participants

- Not surprisingly the aero/auto sector sees the user as a key to the success of DDP systems in the future.
- Cost/performance (as even in this cost conscious industry) ranks as the second most critical key to success - more important than in any other manufacturing industry. Remote sites believe that a vital lever on cost/performance is the availability of cheaper communication costs.
- In common with the process industries, increasing hardware and software compatibility are felt to have the greatest impact on future DDP systems. Next important in this respect are communications trends, particularly as related to cost again!
- Increasing automation in the office received the lowest impact rating of any manufacturing industry. It is felt that the all important cost/benefit trade-offs for office automation is not yet sufficiently attractive.
- The user will, in the majority of cases, pay DDP expenses.
- DDP has, or will replace traditional centralized batch processing (off-line) operations.
- Comments already made on the evaluation of DP structure and organization and the new focal points for selling still apply.

6. DISCRETE MANUFACTURING

a. Overview And Conclusions

- There appears to be a clear line in DDP acceptance in discrete manufacturing based on size of enterprise - most of those above 1,000 employees are planning some form of DDP, and few below 1,000 employees are actively considering DDP.
- No SUEs were identified which are using or planning DDP. This may also be a function of size, since SUEs interviewed by phone had less than 1,000 employees.
- Definitions and understanding of DDP vary even among large companies but this does not seem to reflect experience with EDP. DDP is a fuzzy concept at best.
- The non-DDP companies tended to be organizationally centralized into one location (manufacturing, administration, and warehousing) and, therefore, do not perceive the "need" for DDP.
- The smaller companies are frequently family organizations or "one man" companies which are tightly managed and somewhat suspicious of computer technology in general. There is little tendency to distribute this technology within such organizations.
- Geographic decentralization appears more important than organizational complexity in prompting DDP. However, strong user organizations (or locations) can "force" DDP on DP management.
- Classic applications classifications do not seem to have great significance in today's "data base oriented" systems thinking. The "responsiveness" required in systems seems to be the key.

- There is also the classic "operational" systems versus planning and control systems. Distribution of processing to run a factory or warehouse is readily accepted and data for planning and control is centralized.
- Discrete Manufacturing exhibits a higher degree of "tie-ins" than most other industries between or among systems.
- There appeared to be an underlying desire on the part of DP management to distribute as much responsibility (and expense) as possible back to the end user. This was especially evident with such functions as data entry.
- DDP is assumed to be cost effective, but detailed technical analysis of costs is frequently lacking.
- There does not appear to be significant concern about DDP communications from the point-of-view of either reliability or cost among those who have opted for DDP although improved reliability and lower cost is always desirable.
- Most respondents stated data bases would be distributed, but very few were sure exactly how this would be done. General purpose DBMS systems at remote sites were not expected to provide the answer.
- Discrete manufacturing respondents felt communications trends (satellite, VANs) would have significantly more impact on DDP development than other industries. Whether these trends have been anticipated in planning their DDP systems is difficult to determine.
- Respondents seemed especially sensitive to conversion problems as evidenced by high ratings on hardware compatibility, language availability and software compatibility.
- Discrete manufacturing seemed less sensitive to maintenance capability and price performance than other industries.

- Otherwise responses tended to parallel other industries with product reliability being most important and "one stop shopping" being least important.
- Both vendor applications and networks software were not of great significance in vendor selection.
- The desire for centralized control will probably inhibit the development of ring network structures in the near future. However, those users who already have established hierarchical or hybrid networks are beginning to think about ring structures.
- There are a high percentage of manual systems being replaced in discrete manufacturing and there is an obvious desire to eliminate paper based systems. This extends to the belief that office automation will substantially increase the trend towards DDP.
- Discrete manufacturing appears ready to accept "architectural" distributed processing by providing processors for specific purposes (or organizations) as opposed to the basically geographic distribution which currently exists. This could result in acceptance of DDP by SUEs and the distribution of processing within individual establishments.
- It is concluded that discrete manufacturing varies tremendously from generators and castings to the infinite complexity of consumer products (not to mention computers) and it is difficult to generalize. However, the following may be observed:
 - 1) The degree of awareness and perception among the "leaders" in the industry appears high compared to others.
 - 2) The importance of communications appears to be better understood.
 - 3) The need is there. Factories and warehousing lend themselves to DDP and market analysis and planning are exceedingly dynamic in discrete product manufacturing. This requires "timely" reporting.

- 4) The competitive pressures are more severe than in regulated or "semi-regulated" industries.
- 5) Discrete manufacturing lends itself to "architectural" DDP as well as geographic DDP and already uses more tie-in systems than other industries.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- The most critical factor in determining DDP experience and knowledge in discrete manufacturing is the size of the enterprise. Of seven telephone calls aimed at companies with over 1,000 employees six on-site interviews were conducted with DDP users and only one telephone interview was conducted with a non-DDP user.
- On the other hand, in order to arrange five qualified DDP on-site interviews with companies under 1,000 employees, twenty-one telephone interviews were conducted with non-DDP users.
- The larger companies also provided the three remote interviews which were conducted.
- There is also an indication that discrete manufacturing is especially sensitive to size in future consideration of DDP. Fifty-nine percent of the twenty-two non-DDP respondents indicated growth would cause them to consider DDP. Only 12% of respondents in other industries indicated this was a primary motivating factor.
- It was virtually impossible to find SUEs who had a plan for DDP. Six telephone interviews were conducted with SUEs and none planned to implement DDP in the foreseeable future. (This is also probably related to size since the SUEs interviewed averaged less than 500 employees.)

- Approximately half of the non-DDP users attempted definitions of DDP. These definitions varied from: "Some things processed through a smart terminal," to rather comprehensive definitions. Most respondents identified DDP with communications but some felt individual departments or divisions with their own computers would qualify.
- Of those non-users unable to define DDP, several frankly admitted they had never heard of it. (Among those unable to provide a definition was the DP manager of a prominent terminal manufacturer).
- The average EDP experience of non-DDP users was 9.6 years as compared with 12.1 years for DDP users. This is not considered significant.
- The question concerning DDP experience did not obtain meaningful results except to point out that five user respondents admitted they had no experience, and one stated he had 10 years. (The latter was a consultant and his claim appears valid - which proves terminology lags technology.)
- The "user's" actual view of DDP varied considerably based on size, whether a system was implemented or "planned," and whether the responding location was a host or remote.
 - Companies with over 1,000 employees were able to give definitions of DDP which normally included provisions for: host processing, remote processing, communications facilities, and some logical distribution of work (based on either function or organization).
 - The hosts of the large companies seemed very much aware that DDP implies the controlled distribution of data bases (or at least data files) to remote locations. Definitions included: "Distribution of data/information as well as hardware - matched with organizations."

- On the other hand the remotes seemed to emphasize access to centralized data bases and local processing. (This may represent a perceptual problem - the remotes feeling they are heavily dependent upon the host; and the hosts feeling they are relinquishing some control.)
- Four of the five small companies interviewed had only superficial definitions of DDP (the comprehensive definition coming from the consultant with 10 years experience), and only the most superficial plans. The primary view was one of data entry through intelligent terminals or replication of central systems (manufacturing or distribution) to remote locations.
- A general observation would be that larger companies have achieved some degree of centralized control of information flow using terminals and central computer facilities - they now recognize a requirement to distribute "operational" processing power (and data) back to the end users to improve responsiveness.
- In contrast, the smaller companies have centralized management control, but information flow is still so slow (paper forms) they must improve the information flow in order to be effective (and competitive). They associate the use of telecommunications with "DDP" and feel this may be a solution for them.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- The non-DDP users reported the following incidence of activities at the location being interviewed: Ninety-five percent manufacturing, 90% administrative, and 77% warehousing. This indicates highly centralized geographic locations even though 73% were technically MUE because of a few remote plants or warehouses.

- The smaller companies (non-DDP users) are frequently "one man" or "family" companies which may or may not be experiencing growth. When asked why they did not plan to consider DDP, one respondent stated: "The founders of the company (1937) are still at the helm." Such companies are not necessarily receptive to either new technology or the distribution of anything from the executive offices.
- Small successful manufacturing companies have frequently been built by an individual or small group of entrepreneurs who feel they know their product, industry and marketplace better than anyone else. They have been successful without any significant investment in data processing equipment much less a computer/communications network. The unsuccessful companies know they can't afford anything new.
- In one company, the DP manager reported to the president (his father), the vice presidents were his uncles, and the salesmen were his brothers. This was a company with 900 employees. They installed a Microdata Reality system one year ago for accounting and when asked about using vendor software the reaction was, "No one is interested in taking care of us - but us!"
- DP managers in enterprises under 1,000 employees (where there is a DP manager) report either directly to the President or to the financial Vice President. (One DP manager for a steel casting manufacturer stated: "DP talks with whoever is around - there are no separate levels of management.") It seems apparent the President (or an operating executive) would be directly involved in any decision for the purchase of data processing equipment or communications services. This is true for both non-DDP users and those who have DDP systems planned or in use.
- In contrast to the non-DDP users (where the high geographic and organizational concentration was evident from the primary activities performed at the responding location), the DDP host locations do not demonstrate the same degree of concentration and the larger the enterprise the more significant this difference becomes.

- The following observations, while not startling, are evident from the somewhat limited sample:
 - Geographic concentration of organization discourages the implementation of distributed processing. (Organization charts at single locations may be fairly complex, but if manufacturing, distribution and administrative functions are in the same location they will tend to share a common facility.)
 - Small organizations planning for distributed processing exhibit a greater degree of organizational concentration. (It is also apparent that if the DP function is separated from the administrative function there is a tendency to consider DDP.)
 - In large companies, where the administrative (and DP function is concentrated in headquarters), there is a high probability that DDP has either been implemented or will be.
- There is also the possibility and even probability that in large organizations - even if the DP function is centralized - the operating entities have forced "DDP" by either demanding or justifying their own hardware.
- In one large enterprise (more than 70,000 employees) the statements were made: "DDP evolved through the organization," "some functional areas are independent," and "there is and will continue to be, great internal competition for control of DDP."
- In this regard it is probable that a division (or plant manager) with substantially less personnel than some of the small enterprises interviewed will be able to demand DDP in a large enterprise and receive favorable consideration if he has profit responsibility and is willing to pay for it. (The centralized control of data processing becomes a myth for a strong and successful operating executive who is critical of the centralized DP function.)

- In explaining the justification procedure for DDP, one remote location stated: "We did analysis and justification. Division MIS reviewed. Differences are resolved in favor of the user."
- Centralization of the DP function is a convenient way to obtain control over newly formed or acquired operations. However, once integration of accounting and planning functions are obtained the distribution of operating responsibilities back to the individual organization is quite common.
- For example, the one small company with a DDP plan just made an acquisition which will increase its revenues by over 50%. The consultant responsible for data processing will integrate their systems and reporting by providing them with a minicomputer of their own.

(3) Current And Anticipated Application Structure

- Commonly used applications categories seem to have little significance except in the most general sense. Accounting applications were frequently mentioned and a full range of "manufacturing applications" were mentioned with little specific concentration.
- The actual range of applications was substantially wider than the statistics would indicate. Typical of the remarks received was: "We do everything except payroll."
- Generally speaking, it is difficult to isolate specific new applications data which is of any significance by analyzing these responses.
- However, there are several observations which can be made about discrete manufacturing:
 - Over 70% of the respondents mentioned order entry as a primary application. By contrast, traditional accounting classifications such as accounts receivable were mentioned by less than 30% and even inventory management was mentioned by only 35%.

- The interviews revealed that although order entry was being done, it was a primary candidate for improvement through DDP. Current paper based order entry systems are both slow and inaccurate - this is identified as an area where money can be both "saved" and "made." One major company is planning to have its 750 salesmen be able to dial into local distribution centers or plants to enter orders. (The distribution of the functions being justified based on communications costs.)
- Respondents in discrete manufacturing also reported tie-ins between (or among) systems in 78% of the primary applications mentioned. This compares with less than 40% of the other industry classifications. It would appear the integration of specific applications into broader systems is recognized as being necessary in this industry segment.
- Despite the general applications direction and integration demonstrated by discrete manufacturing DDP users, the non-users were not responsive to the question of which applications they would consider for DDP.
- There is no statistical evidence that the availability of applications software is a critical factor in the adoption of DDP.
 - Currently 57% of the user respondents indicated they had developed their own applications, and only 1 of 14 respondents indicated they would prefer a vendor package.
 - Of the non-DDP respondents, only 3 of 22 said vendor supplied applications would encourage them to go DDP, and 15 of 22 stated categorically "no" to the question of whether vendor software was important in their decision.
- When considering DDP, functional considerations seem more important than classic applications categories.
 - Management planning and control (accounting) systems do not lend themselves to distribution.

- Operational systems requiring responsiveness such as materials requirements planning, production control, inventory and distribution are best placed close to the end user who has responsibility for the plant or distribution center.
- Processing to permit the timely and accurate entry of data into all systems should be placed as close to the responsible organization as possible.
- Any systems (manual or electronic) which produce paper for communication (by mail or messenger) to other internal or external organizational entities should be considered for DDP. The costs of paper communications (postage and other handling) is already more expensive than electronic media.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The study population listed the following six factors as providing the greatest motivation for going to DDP:
 1. Move data management and control to the source.
 2. Timeliness of information reporting.
 3. Cost/performance.
 4. Inefficiencies of a centralized system.
 5. Better customer service.
 6. Flexibility for end user.
- Discrete manufacturing also listed precisely these six factors as being the most important and a higher percentage of the discrete manufacturing respondents endorsed each of the six factors. In fact, these six factors represent over 90% of the responses.

- A summary of the justification or rationale for going to DDP could be stated as follows: "Give the end user both control and responsibility for the data processing necessary to perform his function in the most effective and efficient manner."
- In discrete manufacturing the following amplification of the justification for DDP is necessary:
 - Moving data management and control to the source has dual benefits for DP management: 1) It transfers the data entry function to the point-of-transaction and theroretically should improve both data quality and reduce expense, and 2) If DDP doesn't achieve the expected benefits, DP management is no longer responsible.
 - The timeliness of reporting implies dissatisfaction with the performance of current systems (regardless of whether centralized DP or manual methods are in use). There is no technological reason as to why centralized systems cannot provide equal (or better) service than DDP for reporting. This was the most frequently mentioned factor responsible for the promotion of DDP amongst discrete manufacturing respondents.
 - Cost/performance benefits were assumed to be inherent in DDP by the vast majority of respondents. However, one respondent questioned this by stating: "No one is trying to inhibit DDP, but as far as I'm concerned there is still an open issue - is it cost justified?" DP management appears to be somewhat complacent on this issue primarily because it will transfer expense from the DP budget directly to the end user; e.g., operators will normally be classified as clerks, accountants, supervisors, etc. and have primary duties other than data processing.
 - The inefficiencies of centralized system performance can be related to both equipment or "people" services and priorities. There is great appeal to "giving the user control of his own destiny." This can be read to mean "let him decide on his own trade-offs."

- Better customer service is basically related to responsiveness and the comments on reporting (or inquiry) from centralized systems apply.
- Flexibility for end user is just another means of expressing "give the user control of his own destiny."
- When asked the positive factors concerning DDP, the discrete manufacturing responses pin-pointed four factors:
 - Cost/performance.
 - Timeliness of results (increased throughput).
 - Accessibility for end user.
 - Increased end user involvement.
- These responses support the justification factors outlined above; and, once again, the discrete manufacturing responses parallel those of the overall study population.
- The negative factors for DDP were listed as "loss of control," "administrative complexities," and "end user support" - the same as the study population.
- The justification procedure for DDP is the same as for any type of DP equipment or systems. DP management is normally responsible for recommendations and senior financial or operating management will have approval authority. (It was noted earlier that executive management is more directly involved in the decision process in smaller companies.)
- One remote DP manager in a large corporation stated the decision to go to DDP was: "Dictated by the President who didn't want proliferation of large computer centers. DMIS (the DP management function) dictated use of the 3790 -fared poorly - spent a year to get it to work." Later, competitive equipment was installed within one week and there was the implication that the remote MIS function was in competition with centralized functions.

- Cost/benefit analysis was mentioned by 50% of the respondents as being the primary justification procedure. There was an extreme lack of sophistication among all companies in performing these analyses and no indication that effective follow-up procedures existed. Technical evaluations are still pretty much "seat-of-the-pants" regardless of how complex the procedural justification process may be.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- There were no significant concerns about DDP communications other than a scattering of "reliability," "speed and cost," and "programming." Essentially, the impression was obtained that DDP could be justified with current services and prices. Improved reliability and cheaper service is always desirable but communications did not appear to be a severe inhibiting factor.
- Over 70% of the respondents stated that data bases (or subsets) would be distributed, but there is little understanding or technical agreement as to how this should be done. General purpose "data base" systems are not being planned at remote locations because such facilities do not currently exist. While many companies would like to see a "cook book" solution to the remote DBMS problem, not many expressed much optimism that a solution would appear in the near future.
- One larger company with a sophisticated in-house developed DDP network would like to see TOTAL on its minis, but it is planning to replace its Sanders equipment with Series/I under any circumstances.
- Smaller users were not nearly so enthusiastic about DBMS as one might expect. Only one of five mentioned the fact that DBMS might be desirable (IMAGE 3000 on the HP 3000 - one of the few mini DBMS'). Others were either not DBMS oriented (perhaps indicating they had not been exposed to the concepts), or even negative.

- One DP manager stated: "(DBMS)...it's a limitation - not easily transferrable - won't use." It should be noted that two of the small users were oriented toward the ICL (Singer) System Ten which incorporated relatively simple file management concepts and language facilities.
- In one large company, an interview was conducted with an experienced Director of Telecommunications who expressed some views which are at variance with those of DP management:
 - Most data processing is really "communications" and while DDP has evolved - the communications network will pull it together and this fundamental fact will become apparent.
 - The integration of all "communications" (data, voice, electronic mail and message switching) into a digital network can justify DDP without consideration of the classic data processing functions.
 - If you consider that "data base management" is really an effort to try and manage information, only an integrated communications network can solve the problem.
- Questions concerning DDP applications and transmission methods did not elicit any meaningful information in discrete manufacturing. In fact, it is probable that the terminology "batch" and "interactive" is not appropriate in a DDP network. It is easy to conceive of the "interactive" transmission of enormous blocks of data between (or among) nodes in such a network.
- The range of responses on how long systems could be "uncoupled" in key applications was from less than five hours to "unlimited." The mean in discrete manufacturing was 25.2 hours compared to 28.9 hours for the total population.

- There was no pattern for back-up procedures in discrete manufacturing and it is obviously an area which requires additional consideration on the part of DP managers. The experienced managers know current systems and methods of operation will not prove adequate for back-up in case of failure, but many managers seem to think "manual," "mail," "batch" and "telephone" will suffice.
- Once the flow of information improves current systems will not function to the satisfaction of management, and any DP manager who thinks otherwise is in an extremely vulnerable position.
- The question concerning the impact of various factors on DDP resulted in statistically significant information in only one area - "Satellite, VAN or other communications trends." The respondents rated this factor as having substantially more impact than the total population. In fact, this response was the most significant of any of the rating questions on the entire questionnaire for discrete manufacturing. The respondents obviously feel developments in communications are the key to increased DDP implementation in their companies, and perhaps they are depending upon these developments.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- When asked to identify the most important factors in selecting a DDP vendor, respondents in discrete manufacturing deviated significantly in two areas:
 - Only 18% mentioned maintenance as being important compared to 48% for the total population. This was true even though reliability and availability was rated important (46% for discrete manufacturing compared to 54% for the total population). A possible explanation is the "quality conscious" management in discrete manufacturing expects the product to work at an acceptable level.

- The other significant departure was with 46% of the respondents expressing a desire for compatibility with existing hardware as compared to only 15% in the total population. A possible explanation is that the discrete manufacturing sample included more organizations which had experienced conversion problems in the past. One respondent stated emphatically: "No more conversions." However, discrete manufacturing rated the impact of increased software/hardware compatibility comparable to the total study population.
- The "DDP Vendor Selection Ratings" were analyzed for discrete manufacturing for host sites because it was obvious host management was most influential in the selection process. However, remote ratings criteria were also analyzed and did not deviate significantly from the host rating. The ratings of discrete manufacturing are compared to the total study population in Exhibits III-14 and III-15. The following are observations and interpretations:
 - It has been determined from past studies that respondents tend to rate attributes or events between 2 and 3 on scales of 1 to 5 or 1 to 4 (where 1 is most important and the higher numbers are least important). This phenomenon can be observed in Exhibit III-14, where the ratings were assigned based on "major," "some," "minimal" and "none." The mean of all five factors for the total study population was 2.45.
 - The vendor selection ratings also demonstrate the tendency for the mean ratings on individual items to approach a normal distribution. Both discrete manufacturing and the total study population have mean ratings of 2.4 on the 13 factors. (See Exhibit III-14.)
- Since this tendency seems somewhat consistent, deviations are of primary importance. Exhibit III-15 places the "Vendor Selection Criteria" in rank order for discrete manufacturing and compares the relative importance with the total study population.

EXHIBIT III-14

DDP VENDOR SELECTION RATINGS-DISCRETE MANUFACTURING

QUESTION 21 & 22

(MEAN RATINGS)*

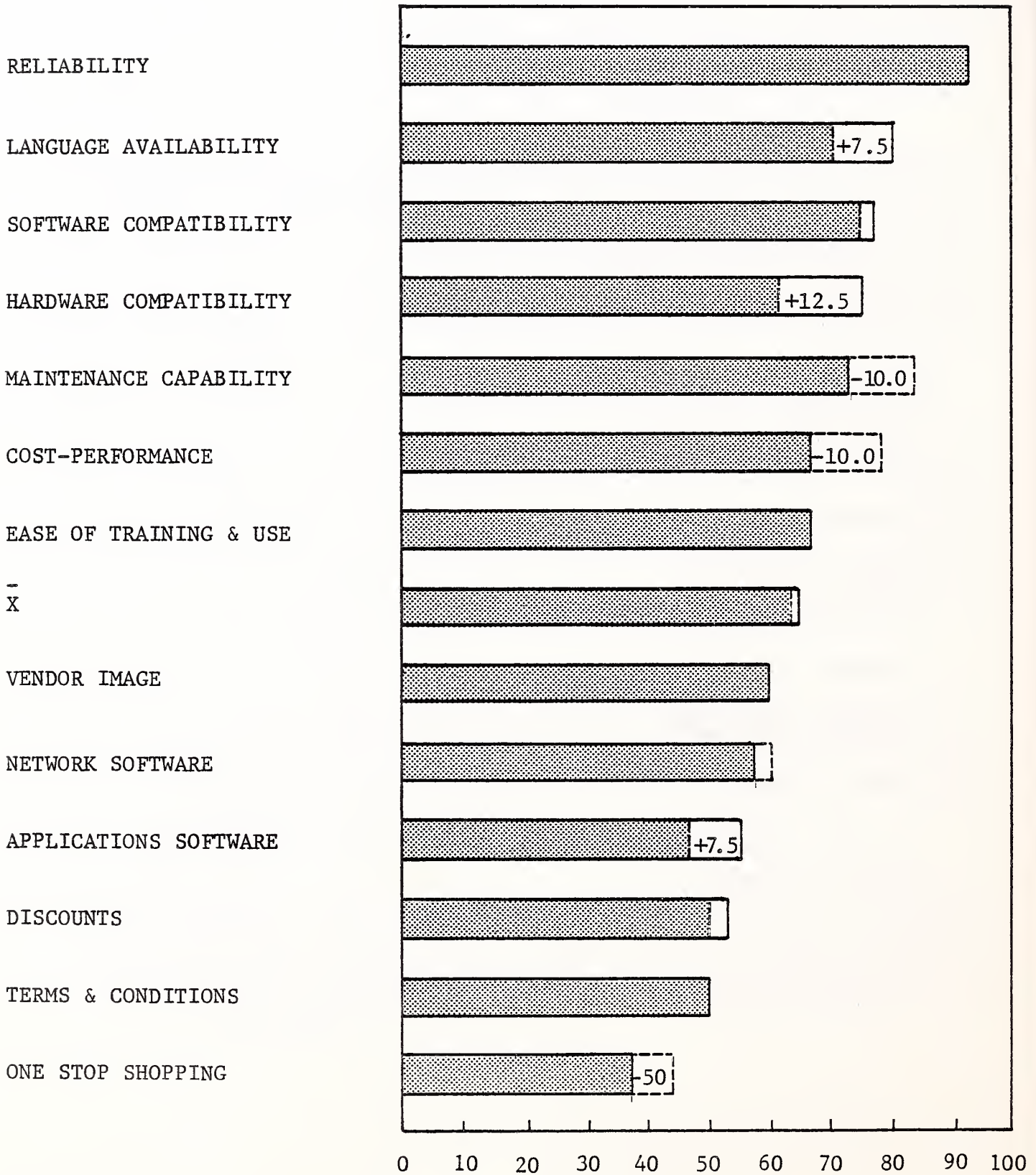
FACTORS	DISCRETE MANUFACTURING	STUDY TOTALS
PRODUCT PRICE-PERFORMANCE	2.3	1.9
PRODUCT RELIABILITY	1.3	1.3
VENDOR IMAGE	2.6	2.6
MAINTENANCE CAPABILITY	2.1	1.7
EASE OF USE	2.3	2.3
DISCOUNTS	2.9	3 0
TERMS & CONDITIONS	3.0	3.3
ONE-STOP SHOPPING	3.5	3.3
HARDWARE COMPATIBILITY	2.0	2.5
LANGUAGE AVAIBILITY	1.8	2.1
APPLICATIONS SOFTWARE	2.8	3.1
SOFTWARE COMPATIBILITY	1.9	2.0
NETWORK SOFTWARE	2.7	2.6
FACTOR TOTALS	$\bar{x} = 2.4$	$\bar{x} = 2.43$

*BASED ON QUESTION RATINGS (1=CRITICAL, 5=UNIMPORTANT)

EXHIBIT III-15

RELATIVE IMPORTANCE* - VENDOR SELECTION CRITERIA

DISCRETE MANUFACTURING



*IMPORTANCE = $(5 - \bar{X}) \times 25$

- Product reliability is of significantly more importance to both discrete manufacturing and the study population (as demonstrated by the mean rating of 1.3). This confirms the result of the open ended question concerning vendor selection.

- The next three items in relative importance to discrete manufacturing are all associated with compatibility (language availability, software compatibility and hardware compatibility), and in all three cases these factors are rated with more importance than demonstrated by the total population. This also confirms the results of the open ended question and discrete manufacturing's concern with conversion which was mentioned above. Hardware compatibility deviates more than any other factor.

- Maintenance capability and price/performance are less important to discrete manufacturing. This also substantiates the open ended question where maintenance capability was not deemed to be as important.
- Ease of use and vendor image are both close in the mean and this is understandable since they are rather vague factors. The "ease of use" rating does deviate from the importance which is normally associated with it when asked in other contexts in previous studies. This is probably the result of the terminology on the questionnaire which was "ease of training and use."
- Networks and applications software do not appear to be of major importance in vendor selection. This is difficult to interpret since it is popular to assume that software is the key factor in DDP implementation. Perhaps workable software is lumped under the general category of "reliability" which seems to be a general expression for "make it work."
- Discounts and "terms and conditions" cluster together as would be expected and do not appear to be of major importance.

- The low ranking for "one stop shopping" is significant. Users have evidently accepted the fact that there will be multiple vendors in a DDP environment and feel different products and services can be accommodated.

(7) The Future For Remote And Host Participants

- The trend will continue to be to distribute data entry functions to remote locations. The data requirements of hosts for planning and control purposes will be centrally defined and remote locations (or organizational entities) will be held responsible for the integrity of the data over which they have control.
- This implies there will be a trend from star networks to hierarchical and hybrid networks. There is little indication that actual plans existed to connect remotes in a ring structure in the immediate future. The desire for centralized control still exists as demonstrated by this response in answer to a question relating to the negative factors attributed to DDP. However, the more experience respondents had with DDP, the more inclined they were to see the desirability of directly connecting remote locations.
- The DDP systems which will be installed will replace both batch and manual systems. In fact, 45% of discrete manufacturing respondents indicated the planned systems would replace manual methods. This is substantially higher than the 27% of manual replacement indicated by the total population.
- There will be a primary impact regardless of whether batch or manual systems are replaced on paper media. Several users specifically mentioned both the cost of paper and the difficulty in handling (processing) paper forms. (One respondent did a quick mental calculation and found he was spending more on paper forms than he was for computer hardware.) This will result in a significant shift toward the use of more on-line storage and CRTs and fewer printers. Paper is a nuisance in a factory.

- The MUE and SUE question has been discussed previously. At present, the trend toward DDP has been toward "geographic" distribution of processing and the perpetuation of centralization at the enterprise level. There are indications that discrete manufacturing may move toward "architectural" (or organizational) distribution of processing. (The higher percentage of system tie-ins supports this conclusion.)
- If "architectural" distribution of processing develops, it will have the following consequences:
 - SUEs will be more receptive to DDP.
 - Remote locations will distribute processing within the establishment.
 - "Architectural" distribution of processing leads naturally to a "ring-like" structure with individual minis and/or intelligent terminals communicating directly with each other.
- Half of the respondents feel that the trend toward office automation will increase the trend toward DDP, and over 25% feel this impact will be major. The elimination of paper from the factory may be followed by the reduction of paper in the office as processing is distributed on an organizational basis.

7. BANKS

a. Overview And Conclusions

- Commercial banks and savings and loans (S&L) are prime users of distributed data processing. Nearly 70% of the respondents either had installed or were planning to install DDP systems (see Exhibit III-16). However, it is important to emphasize that this particular sample represented only about 10% of the total banking population in the United States. The research found that the market potential is particularly attractive for banks and savings and loans who have assets of over \$2.0 billion. DDP potential is still good (66% positive response) for banks with assets between \$500 million and \$2 billion, but falls off rapidly (28% positive response) for banks having assets of less than \$500 million.

EXHIBIT III-16

ASSET DISTRIBUTION OF BANKS AND S&Ls CONTACTED

TYPE	ASSETS (\$)				
	50-499M	500M-1.9B	2.0-9.9B	10B+	TOTAL
NUMBER CONTACTED	7	9	7	2	25
NUMBER INTERVIEWED	1	4	6	2	13
NUMBER DECLINED WITH DDP	1	2	1	0	4
NUMBER WITHOUT DDP	5	3	0	0	8

- The distribution of banks and S&Ls interviewed is shown in Exhibit III-17. The money center banks (assets above \$10 billion) are heavily involved in DDP. All types of regional banks and S&Ls whose assets range between \$2 and \$10 billion are involved in DDP in some way or other. DDP involvement extends to international operations.
- Branch banks whose assets are at least \$1 billion were found to be using DDP for transaction data capture and for branch consumer operations. Multi-bank holding companies in states which still do not allow branch banking were found to be equally involved.
- The research confirmed that independent unit banks whose assets were less than \$1 billion by virtue of their centralized nature were not involved in DDP.
- Banks and S&Ls are turning to distributed data processing because their mainframes are overloaded. The nature of the commercial demand/savings applications result in high transaction volume processing against large information files which can only be economically justified on a batch or remote batch basis.
- Contrary to the above is the requirement for consumer service through on-line inquiry with reasonable response (2-5 seconds) time. The ultimate goal of DP managers is to off-load the transaction processing onto interactive minis, thereby opening a window (time) for batch processing at night.
- Those multi-bank holding companies with strong management have separated data processing from the lead bank and established bank service companies. The interviews indicated that those who had done so were further along in the use of DDP for their member banks.

EXHIBIT III-17

ASSET DISTRIBUTION OF BANKS INTERVIEWED ON-SITE

TYPE	ASSETS (\$)				
	50-499M	500M-1.9B	2.0-9.9B	10B+	TOTAL
UNIT	0	0	1	0	1
BRANCH	1	2	2	2	7
MULTI-HOLDING	0	2	1	0	3
INTERNATIONAL	0	0	2	0	2
TOTAL	1	4	6	2	13

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- Bank and S&L executives involved with in-house data processing are very senior and well-informed people. They are vice presidents, some are senior vice presidents, and those who head bank holding company data processing service organizations are usually presidents.
- Over 90% of those interviewed had 9 or more years experience in DP (nearly 70% had 15 or more). They were easily approachable. Their willingness to be interviewed frequently in excess of two hours attested to their interest in distributed data processing.
- Executives' definitions of DDP were a direct reflection of where they were at in their DDP evolutionary cycle. There was unanimous agreement that telecommunications was the key to any distributed system and that intelligence at the node was essential for effective implementation.
- Bank and S&L executives' basic motivation for implementing DDP is to off-load the host and stem the relentless tide of large mainframes.
- All of the respondents interviewed defined DDP in the context of a centralized host controlling intelligent nodes.
- Respondents' definitions of DDP are shown in Exhibit III-18. Nearly half (48%) defined DDP as off-loading the primary functions of data entry, data capture and some on-line teller functions. An additional 25% added the shifting of some computational functions to the remote site. Two (17%) decoupled daily transaction processing from the mainstream of commercial banking applications; i.e., batch.
- The DDP concept of independent processors interconnected in ring or hybrid structures was evidenced in the thinking of only one respondent.

EXHIBIT III-18

BANKING RESPONDENTS' DEFINITIONS OF DISTRIBUTED DATA PROCESSING

COMMENTS	NUMBER OF RESPONDENTS
OFF LOAD FROM MAINFRAME DATA ENTRY, DATA CAPTURE, AND ON-LINE FUNCTIONS THROUGH COMMUNICATIONS NETWORKING	5
DISTRIBUTION THROUGH ELECTRONIC COMMUNICATIONS OF BOTH DATA AND COMPUTATION WITH INTELLIGENCE AT REMOTE END	3
OFFLOAD DATA INPUT/OUTPUT AND ON-LINE PROCESSING THROUGH COMMUNICATION NETWORKING TO OPEN WINDOW FOR BATCH PROCESSING ON HOST	2
DECOUPLE RESOURCES TO ACCOMPLISH JOB MOST EFFICIENTLY USING TELECOMMUNICATIONS TO INTERCONNECT RESOURCES	1
"YOU NAME IT. IT'S A BUZZ WORD FOR WHAT WE'VE BEEN DOING FOR A LONG TIME."	1

- As might be expected, one respondent was a maverick in feeling DDP was only a buzz word for what had been going on for a long time in the banking industry.
- All but one of the respondents used IBM host mainframes. However, as a group they were well acquainted with other vendor offerings. Many of the satellite and remote mini systems currently installed or planned on being installed through 1982 were from vendors other than IBM.
- Although IBM mainframes predominated, the respondents were not favorably impressed with IBM in relation to DDP. Respondents as a group feel that IBM has been dragging its feet with respect to DDP.

(2) Impact of Management Style And Organization Structure On DDP Implementation

- By their very nature, banks and S&Ls are highly centralized organizations. Involvement in distributed data processing is through a centralized host. The Vice President (Director) of Data Processing (information systems) is the man to see. He usually reports to the senior Vice President for Bank Operations in large banks with branches.
- If a multi-bank holding company is strong, the Vice President of Data Processing can be found in a wholly owned bank service company. Otherwise he will be located in the lead bank.
- The usefulness of selling to remote sites is non-existent. This holds true even for individual banks in a multi-bank holding company.
- The banking industry exercises very strong centralized control (79% of respondents interviewed) over system development and equipment procurement. This holds true even for unit banks in a multi-bank holding company. Some member banks may buy their own hardware but its authorization and procurement have been controlled by the holding company (or by lead bank veto).

- Management experience with data processing follows a natural progression for multi-bank holding companies. The holding company is formed by the lead bank which is usually at least a factor of 5 larger (in assets) than the next member bank.
- Initially, there is a wide disparity of data processing equipment and systems among the member banks. Management attempts to pull in the reins and centralize data processing through remote site equipment elimination, transporting the data via courier to the central site.
- Once centralized control and processing is established, the holding company forms a service company and user professional management (DP specialists) are employed to run the data processing function.
- The longer it takes for centralized control to be established, the slower the use of DDP by member banks. Centralizing processing accelerates the rapid growth of host CPU size.
- The users begin to complain about the quality (flexibility) of the service and the DP manager responds by off-loading (distributing) appropriate functions from the host, returning strategic functions (data entry, inquiry, account control) to the end user.
- Significant remarks in relation to the interplay between DDP and bank management organizational structure are shown in Exhibit III-19.

(3) Current And Anticipated Application Structures

- Banks and S&Ls are using distributed data processing in portions of day to day commercial operations. At the lowest level, data entry is distributed through a combination of on-line data entry and remote satellite item processing.
- The largest banks are in the process of off-loading the daily transaction processing from their mainframe to a distributed mini network. Several of the very large banks have successfully accomplished this transition.

EXHIBIT III-19

INTERPLAY OF DDP AND BANK AND S&L MANAGEMENT STYLE AND ORGANIZATIONAL STRUCTURE - TYPICAL COMMENTS

- "We are a holding company with 8 banks and 120 branches. The data processing is here at the lead bank. We are slow in getting our act together but are moving in the direction of integrating holding company operations."
- "We currently do little DDP. We have a satellite system doing data capture. We are in the process of centralizing our proofing operations. We will than establish two (2) more satellite centers and distribute data entry."
- "We are a very large bank which years ago decided to emphasize centralizing our operations. Now we are distributing everything that doesn't impact our applications programmers and allows the function to be transparent."
- "A consulting company has recommended that DDP report directly to the executive vice president of the holding company to gain greater visibility in implementing DDP."

- Very large money market banks operating in foreign exchange and international funds transfer are also turning to DDP to create corporate funds transfer and servicing networks.
- Distributed data processing is being used in the following applications:
 - Demand Deposit Accounting.
 - Savings.
 - Commercial and consumer loans.
 - Consumer inquiry.
 - Remote data entry.
 - Foreign exchange.
 - Funds transfer.
 - Correspondent banking.
- The complete off-loading of daily consumer transaction processing is being accomplished as follows. The distributed system consists of from 1 to 2 processing modules. Each module consists of a dual set of transaction processors. Each night the host produces a new account data base which is down-loaded (distributed) among the transaction processors. The message processors are connected to the branch terminal network. Each module is also interconnected.
- During the day DDA, savings, loans, new accounts and account changes are received by the message processors, routed to the appropriate transaction processor and the distributed data base is updated. The system achieves very high reliability through automation switching (Automatic Bus Transfer Units) of failed processors through detection by the communications monitor processor.

- After the close of business, the log tapes are sent to the host. All items but DDA transactions are pulled for processing against the master file. The MICR DDA items are processed via the item processing system (proofing, clearance, etc.)
- The use of distributed processing for commercial bank (S&L) consumer transaction processing is being accomplished as follows. The remote site MICR is a communication controller controlling a cluster of teller units, administrative terminals and on occasion, customer inquiry units. The ATMs are connected to the host via separate communication lines. A recently deployed mini MICR system records items on diskette for RJE transaction to the host. The MICR items are sorted, the "on us" held and the other MICR items entered in the clearance network.
- There is a requirement for a future remote site mini to integrate the ATM and MICR data capture applications with the consumer transaction system. The mini would interface with an EFT communications processor which would route the financial transaction to the appropriate host.
- The local data base at the remote site would contain the customer records for that branch(es).
- Foreign transactions are routed through the remote site mini and the EFT communications processor to the appropriate host in the EFT network. The local data base is refreshed by the bank host after the evening's batch processing is completed.
- The use of distributed processing for correspondent processing (including unit banks in a multi-bank holding company) is illustrated as follows. In the current system, the MICR items (DDA, savings, loans) are captured, edited, and batched on tape. At the end of the day the batches are transmitted to the host (RJE). The results are returned (RJE) to tape and printed for delivery the next morning. The "on us" sorted MICR items are returned to the originating bank and the other items are entered into the clearance system.

- Very large banks (and bank service companies) have requirements for an enhanced satellite system. The system becomes in effect a node to an EFT network. This configuration applies in those states where ATMs must be shared among participating banks.
- The local data base services the assigned ATMs for the subscribing banks. Other ATM transactions are routed through the satellite mini and the EFT communication processor into the EFT network.
- The use of distributed processing for commercial bank international operations (foreign exchange and funds transfer) is illustrated as follows. In present systems, the Fed wire and Bank wire funds transfer networks are standalone operations. There is a mini connected to the host which interfaces with the Society for Worldwide Funds transfer (SWIFT) network.
- The bank usually has minis connected to the host both at U.S. money market centers; e.g., New York and San Francisco and in Common Market Centers; e.g., London and Paris.
- Very large banks are in the process of integrating their foreign exchange and funds transfer networks in a distributed network. A mini will control both routing and access. The Fed wire and Bank wire networks will go on-line.
- The mini will utilize a data base to control corporate access and use of the international foreign exchange and funds transfer network. Terminals will be located in client corporate offices to enable the financial executives to have immediate access to money market information and to order funds transfer on both a domestic and international basis.
- The banks (S&Ls) interviewed were not tied into office automation. Only one of 13 was tied into word processing in some way. The data correlated well with the low (25%) impact respondents felt office automation could have on their use of DDP.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The primary decision to employ DDP at a bank (S&L) is made within the Data Processing (Information Systems) group. However, user requirements for the DDP system are supplied through an EDP steering committee. Composition of the steering (standing) committee will vary somewhat depending on bank size and type.
- For large banks involved in branch operations, one or more branch vice-presidents, the bank operations, administrative, and DP officers make up the steering (standing) committee.
- The board of directors, which is comprised of member bank presidents, constitutes the committee for services companies in multi-bank holding companies. Liaison is maintained with the senior operations office of the lead bank.
- Very large banks develop their DDP requirements as part of their planning cycle (5 year). The DP executive executes the plan and makes all the decisions short of large capital expenditures (more than \$0.5 million). Large S&L management structures are much smaller than those of banks of equivalent asset size. The EDP role is vested entirely with the DP executive.
- Final product selection is eventually made by the DP executive with major decision approval obtained from a chief operating executive. Since selection will have the blessing of the steering committee, operating executive approval usually represents "rubber stamping."
- As expected, the respondents gave a wide variety of responses on how their DDP systems were justified. Typical remarks are noted in Exhibit III-20. There is an attempt to justify DDP using a people/equipment replacement rationale with a return on investment (ROI) methodology. However, behind it all is the pressure of the consumer marketplace.

EXHIBIT III-20

BANKING RESPONDENTS' DESCRIPTION OF THE DDP JUSTIFICATION PROCEDURES - TYPICAL REMARKS

- Cost justification was based on:
 - Branch phone calls saved.
 - Reduction in overdraft losses.
 - Reduction in data entry costs at host site.
 - Reduction in growth of teller personnel by speeding up consumer service (teller lines).
- "We favor the pilot project approaches - we get a few units first and see if it's what we want."
- "We do a full cost study."
- "We have an approved 5 year plan - we don't need to justify our equipment selection, just get approval for expenditures over \$500K."
- "We can do what we want within the service company. Large capital expenditures go to the board."
- "We are taking the conservative approach and sticking with IBM."
- "We do pilot installations and evaluate the results before plugging into our own network."

- Accordingly, the methods employed by both the very large money center banks (needing to provide immediate and 24 hour customer service) and the S&Ls (who have led the way using on-line systems), have filtered its way throughout the banking (S&L) system.
- This has been accomplished either through direct DDP system installation, through correspondent bank processing, or through bank (S&L) remote computing data services companies.
- Several respondents use pilot installations (R&D) to ease-in DDP systems without fanfare.
- Banking executives responded in the same pattern as total respondents interviewed for all industry groups in rating product reliability, maintenance capability, price/performance and hardware compatibility as the most important criteria in selecting a DDP vendor.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Banks by their organizational structure have highly centralized data bases. Respondents were equally divided about their intentions to distribute the centralized data base.
- Those banks which distribute their data bases do so by down-loading from the host. The distributed data base is for "memo pushing" of consumer transactions. The centralized master file is later updated on a batch basis from a transaction log. The new copy is down-loaded to the remote site following completion of batch updating of the centralized master data base.
- The distributed data bases are used for the primary bank consumer applications of DDA, savings, loans, central information file (CIF) inquiry, and account changes.

- All but the largest money center banks (assets greater than \$10 billion) are regional and have few concerns regarding DDP communications. Accordingly, most respondents (61%) expressed few concerns in this area.
- A few (23%) feel that data communications costs impacted their use of more on-line systems.
- Only the very large money center banks felt that they would be using satellites, VANS, or advanced communications in a distributed mode.
- The survey results added credence to the trend that banks are shifting their data communications from remote batch (RJE) to on-line methods. Respondents reported a shift in the proportion of total data communications devoted to interactive operations from 18% in 1977 to 32% by 1982. Nonetheless, remote batch (RJE) methods will still dominate over the next four years.
- Banking has shifted to DDP to relieve the massive key data and batch data entry application at the host site. Over 80% of the respondents reported that this was the primary DP method which DDP replaced.
- Banks accomplish this shift in a variety of ways. On-line teller and administrative terminals are used at remote sites to enter new account, account changes, debits, credits, and savings and loan transactions.
- Satellite systems are used for remote data capture of MICR DDA items. On-line teller and consumer terminals are used remotely to access a (CIF) for account status. Minicomputers with multiple packet proof machines are used to capture MICR items at the source in branch banks.
- By utilizing remote data capture, banks have also greatly reduced the number of people and machines required to proof MICR items before data entry into the item processing system. The replacement of data entry and proofing equipment at the host represent the major portion of the cost savings used to justify going to DDP.

- All but the very largest money center banks reported that they could successfully operate with the remote sites uncoupled from the host. Over 80% of the respondents felt that they could operate successfully for over 10 hours without DDP communications.
- This is due to a combination of factors including:
 - Transaction storage at the remote processors.
 - The capability of operating without the host for extended periods (through the design of satellite and remote systems).
 - The availability of ground transportation as a back-up if absolutely necessary.
- Foreign exchange and corporate funds transfer become the critical applications for money center banks, where literally tens of millions in money market funds are involved on an hourly basis.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- The most important factors banking executives consider in selecting a DDP vendor are listed in Exhibit III-21.
- Reliability and maintainability at remote locations rate high on their list of important factors in vendor selection.
- There is no doubt that IBM 370 system compatibility is an important factor. It is believed that this can be achieved through "3270" emulation currently and through SDLC compatibility in the future.
- The banking DP executive is clearly the key person to contact in making a DDP sale. For multi-bank holding companies member bank presidents (alternatively bank operations officers) are useful contacts to stimulate interest in new offerings.

EXHIBIT III-21

MOST IMPORTANT FACTORS IN SELECTING DDP VENDORS
AS REPORTED BY BANK DP EXECUTIVES

FACTOR	NUMBER OF TIMES SELECTED
MAINTENANCE/SERVICEABILITY	5
EQUIPMENT RELIABILITY	4
HARDWARE/NETWORK COMPATIBILITY	4
PRICE/PERFORMANCE	3
LANGUAGE COMPATIBILITY	2

- The sale of DDP hardware is becoming increasingly coupled with software. This will eventually result in a total systems approach to selling DDP.
- NCSS and ADP network services offerings of on-site hardware with maintenance support, networking and software are precursors to the future.
- Exhibit III-22 lists the primary software products and network architecture required for successful marketing of DDP systems to banks and S&Ls.
- Bank DP executives are increasingly turning to software vendors to buy DDP applications packages where possible rather than developing them in-house. For example, a group of banks are funding Banking Systems Inc. (Dallas) to design a comprehensive DDP processing system to off-load daily consumer transaction processing using a set of minicomputers (IBM Series/I class).
- The banking industry has some specialized data security requirements. By using systems for customer records, they require routine user identification for file access for both inquire and account entry.
- The computer services company in a multi-bank holding company has requirements for positive hardware identification when dropped communication lines are used for both member and correspondent banks.
- Positive hardware identification will also be required when ATMs are incorporated into an EFT network shared by multiple users; i.e., banks and S&Ls.
- Communication encryption is of high interest to banks and S&Ls for transmission of funds transactions using both shared ATMs as well as when the bank is involved in foreign corporate funds transfer operations.
- Exhibit III-23 indicates respondents assessments of those vendors judged to be leading the promotion of DDP.

EXHIBIT III-22

SYSTEMS SOFTWARE AND NETWORKING REQUIREMENTS OF BANK

DATA PROCESSING RESPONDENTS

SYSTEMS FUNCTION	NAME	HOST		REMOTE	
		REQ	NEC	REQ	NEC
SOFTWARE					
LANGUAGES	COBOL	X			X
DATA BASE MANAGEMENT SYSTEMS	DMS-1, DL-1, DBMS	X			
APPLICATIONS	TURNKEY		X	X	X
NETWORKING					
ARCHITECTURES -	SNA		X		X
PROTOCOLS	SDLC	X		X	
	BYSYNCH (ASCI)	X		X	
	"3270 EVALUATION"	X		X	
	X-25	X			X
HARDWARE/SOFTWARE INTERFACE	CICS/VTAM	X		NA	

REQ-REQUIRED

NEC-NECESSARY/DESIRED

NA-NOT APPLICABLE

EXHIBIT III-23

BANK RESPONDENTS' PERCEPTIONS OF VENDORS MOST INFLUENTIAL
IN PROMOTING DDP

VENDOR	NUMBER OF TIMES SELECTED	REASONS GIVEN
DIGITAL EQUIPMENT	7	GOOD EQUIPMENT AND GOOD BUT HIGHER PRICED THAN OTHER MINIS
GENERAL AUTOMATION	4	HANDLING OF TELEPROCESSING ENVIRONMENT
HEWLETT-PACKARD	2	OPERATING SYSTEMS NETWORK INTERCONNECTION
FOUR-PHASE	2	GOOD CREDIT SYSTEMS
INTERDATA	2	GOOD TELEPROCESSING
INCOTERM	2	GOOD TERMINAL CLUSTER CONTROLLERS

- Exhibit III-24 presents some comments regarding those vendors who are judged to have not promoted DDP.
- Finally, Exhibit III-25 highlights banking executives' comments with regard to IBM's current role in DDP. As noted earlier, respondents as a group believe that IBM has been "dragging its feet."

(7) The Future For Remote And Host Participants

- Banking, by its centralized and well-defined specialty application nature, will have host and remote participants closely coupled together.
- However, satisfying remote user requirements was the most important criteria for over 67% of host respondents.
- Attitudes toward DDP were positive (75% rated it at least very good). Banking users have had sufficient experience with employing DDP for remote data entry and data capture, and are finding it economical to use DDP to off-load daily consumer transaction processing. The concept of moving data responsibility to the area of primary responsibility appears to be well accepted.
- Banking executives did not voice strongly negative attitudes toward using DDP. They cited some problem areas such as remote site maintenance and increased personnel training requirements. Overall they felt that DDP was one of the more promising of a number of alternatives available to them; e.g., the use of large or dual mainframes, the off-loading of specific applications such as corporate or personal trust, or resorting to services vendors.
- They wished IBM was more involved with them in effectively supporting DDP.
- The future (1979-1982) plans for DDP hardware deliverables for the banks interviewed are shown in Exhibit III-26. The basic motivation that respondents have to go to DDP stems from checking the growth of their mainframes. This is quite evident as a result of only one of the 12 respondents having an IBM 30XX on order!

EXHIBIT III-24

RESPONDENTS' PERCEPTION OF THOSE VENDORS INHIBITING THE USE OF DDP

VENDOR	NUMBER OF TIMES SELECTED	REASONS GIVEN
IBM	4	VERY LATE IN MARKET DRAGGING THEIR HEELS RELUCTANT TO GIVE UP LARGE HOST CONCEPT
BURROUGHS	2	NOT YET DEVELOPED PRODUCT TO SATISFY DDP NEED OF BANKING USERS
NCR	1	BEEEN WAY OUT OF IT UNTIL RECENTLY

EXHIBIT III-25

BANK RESPONDENTS' REMARKS CONCERNING IBM's ROLE IN DDP

- "The SNA/SDLC network environment requires a lot of host overhead and is not very flexible."
- "We looked at the IBM 3790 and it's a nightmare."
- "Up to recently, IBM has been dragging its feet in DDP."
- "We wanted them to bid the Series/1 but they responded with a System 34 which would not meet our requirements and is not competitively priced."
- "When it comes to distributed processing IBM is like several separate companies. Different groups seem at cross purposes with one another."
- "In last 6 months IBM has been gearing up. Up to then they were:
 - not flexible in cost,
 - not flexible in mini architecture and their
 - programming languages for minis was weak."
- "The 3790 is a dismal system, the 3600s are just barely acceptable."

EXHIBIT III-26

HOST AND REMOTE EDP SYSTEMS ON ORDER OR PLANNED (1979-1982)

FOR THE BANKING SECTOR

BANK (S&L)	TYPE	SIZE OF ASSETS	MAINFRAMES		MINIS	
			TYPE	NUMBER	TYPE	NUMBER
1	MULTI-BANK HOLDING CO.	\$1.5B	NONE		"B1700" FOUR-PHASE	4 1
2	BRANCH BANK	1.8B	IBM 3031	1	"B1700"	2
3	BRANCH BANK	2.3B	NONE		NONE	
4	BRANCH BANK	250M	IBM 370/145	1	DATAPoint	50
5	INTERNATIONAL BANK	5.1B	NONE		"GA MINI" "B800"	1 4
6	S&L	2.0B	"DEC 10/20"	2	"GA 16/550"	2
7	MULTI-HOLDING	2.0B	370 158	1	INCOTERM COMTEN B1200 PANSOPHIC	8 1 5 1
8	MULTI-HOLDING	1.8B	NONE		SYS34 PTS1200 COMTEN	1 40 1
9	UNIT	800M	NONE		"GA MINI"	4
10	INTERNATIONAL	4.9B	NONE		B1500 "GA MINI" "ATM MINIS"	10 1 2
11	BANK HOLDING CO.	12B	NONE		GA 16/440	4-6
12	BANK HOLDING CO.	10B	NONE		DATA 100 COMTEN B1100s "BRANCH MINI"	9 2 200 200-300

"B1700" MEANS MINI OF THAT CAPABILITY
GA=GENERAL AUTOMATION

- Respondents felt that governmental constraints (federal, state and international) would have the greatest impact on their use of DDP. Exhibit III-27 illustrates typical respondent comments as to anticipated particular constraints and the direction (increase or decrease DDP) of their impact. The majority (59%) felt that the overall effect would result in the increased use of DDP.

8. SCHOOL DISTRICTS

a. Overview And Conclusions

- Due to the very small sample size and the geographic clustering obtained in this industry sector, results may or may not be representative of the entire sector.
- External factors in the form of pending state legislation may seriously reduce funding available to local school districts in this sample group.
- Other state legislation taking effect in September 1978 will permit individual students to pursue their education in a less formalized instructional/classroom environment. Each district will establish its own objective and implementation plans, heavily dependent upon funding levels.
- School districts in this sample largely follow the same development path as colleges, providing interactive student services and batch or on-line administrative services. One district also provides an on-line building maintenance program and sells services to other school districts.
- Uncertainties relating to future funding make it difficult to forecast what the future will bring. Users recognize the need, advantages and potential of DDP, but may not be able to implement it as rapidly as desired.

EXHIBIT III-27

IMPACT OF GOVERNMENTAL CONSTRAINTS ON THE FUTURE USE OF DDP

TYPICAL BANKING RESPONDENT COMMENTS

COMMENTS	TYPE OF AGENCY	USE OF DDP
"Beginning July 1, we will be required to share our use of ATM with other participating banks (S&Ls)."	STATE	INCREASE
"We are concerned about the unauthorized disclosure provision of the privacy act."	FEDERAL	INCREASE
"We are concerned about the data transmission and data security requirements especially in Europe."	FOREIGN GOVERNMENTS	DECREASE
"The federal ruling that off-site ATMS do not constitute a branch location will accelerate use of distributed networks."	FEDERAL	INCREASE
"The privacy act in U.S. will increase our use of DDP whereas the data security requirements of European postal networks will constrain it."	FEDERAL FOREIGN GOVERNMENTS	INCREASE DECREASE
"The new state law that ATMS are required to operate 24 hours/day will increase our use of DDP; we don't want the mainframe always on-line."	STATE	INCREASE
"The growth of EFTS systems will increase our use of DDP."	FEDERAL	INCREASE
"New accounts will increase our use of DDP."	FEDERAL	INCREASE

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- School districts have adopted the data processing model of higher education institutions by offering instructional programs to students, recordkeeping schedules and financial/accounting programs to administrators, and maintenance or other miscellaneous operational programs. They may also sell services to outside agencies.
- Managers in this sample were thoroughly familiar with the concept and advantages of DDP and have in some cases been doing DDP with or without telecommunications for several years.
- Other districts feel that close physical proximity of their schools, plus the present "high costs" of DDP do not make it an attractive alternative at this time.
- There is some sharing of services with other districts and/or with the county government.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- DP Managers in school districts play a key role in initiating, structuring and implementing DDP.
- Final approval of DDP plans depend on the concurrence of a Business Manager or Assistant Superintendent, Superintendent, and Board Of Education - normally based on the DP Manager's recommendations and availability of funds.
- Implementation may be performed in phases by schools within the district, and may be implemented at the secondary or elementary school level. If outside funding is involved, it may affect only certain schools within the district.

(3) Current And Anticipated Application Structures

- Student registration, student scheduling, attendance accounting, and grade reporting are common DDP applications for school districts.
 - One district reported the ability to offer daily demand reporting for period-by-period attendance.
 - The same district is planning to be able (from the host end) to analyze and compare student educational progress in each school against daily assignments and tests.
- Most of the districts also did some financial/accounting/budget applications, but not the full spectrum on a distributed basis. Interestingly, financial systems did not appear to be a primary motivation either for DDP or EDP.
- One district also had major energy management and building maintenance applications currently in place.
- With the exception of registration when it occurs, none of the applications were considered critical, and could be unavailable for a day or more at a time.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- Most school district systems were installed originally to handle student instruction and recordkeeping requirements.
- As transaction volume increased, it became cost effective to move the data bases closer to the users who are responsible for them and to increase throughput by increasing accessibility.
- Increased reporting requirements to outside agencies (county, state and federal) required additional recordkeeping.

- Reasons cited for non-adoption of DDP were:
 - "Schools are geographically tightly clustered."
 - "Funding not available."
 - "Hostile legislation."
 - "Lack of vendor applications for school operations."

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- The primary motivation for distributing the data base is to put the responsibility for accuracy and integrity on the user where it is deemed to belong.
- The district not planning to distribute the data base may do so when it adds additional schools to the one that will originally participate in the system.
- No district is currently using a DBMS nor do they plan to do so with current heavy overhead requirements attached to DBMS.
 - One installation would "take a look if a good distributed system were available."
 - Another installation is wary of being "locked in" to a non-transferable DBMS.
- The compatibility factor was also mentioned by all users in connection with communications software.
 - One user said he would "stay with standard communications protocols" and "does not like SNA."

- Another district was concerned about whether the rising costs of DDP telecommunications would "become so burdensome as to negate the positive features of DDP."

(6) Vendor Characteristics For Getting And Keeping DDP Business

- Price/performance and cost related factors are critical to school districts and rank slightly ahead of reliability and maintenance.
- Availability of applications software is also considered very important but at least one district accesses (and is accessed by) other districts where additional applications are available.
- The compatibility of software and availability of network interconnect with software are desirable features for these reasons.
- Competitive formal bidding is a common procurement technique. Bids will normally be evaluated by a committee and the winning bid validated by a vote of the Board Of Education.
- No district mentioned a mainframe manufacturer as having a positive influence on DDP. Companies that do have a positive image are:
 - DEC.
 - Datapoint.
 - Hewlett-Packard.
 - Wang.
 - Harris.
 - Texas Instruments.

- Reasons for preferring these companies centered about their product offerings, compatibility and perceived commitment to DDP.
- The only company mentioned in an unfavorable context was IBM "for really dragging its feet."

(7) The Future For Remote And Host Participants

- No remote contacts were made in the school district sector.
- This may be an indication that individual schools have little to say about budgets and expenditures for DP.
- The present impetus to DDP in school districts has been centrally motivated and is likely to continue to be so in the future.

9. HOSPITALS

a. Overview And Conclusions

- The hospital industry has long been a proponent and important user of data processing equipment and services. However, it does not appear to INPUT to represent the same proportional capacity for DDP equipment and services.
- The standalone hospital is a physically limited structure usually located under one roof. Data processing has evolved as a centralized or host function and as such remains oriented towards on-line and data base philosophy.
- As such, DDP will have a difficult time unseating the on-line or general purpose business computer approach to hospital data processing. However, the opportunity and marketplace for DDP still remains, although somewhat limited, to areas not yet significantly impacted by centralized data processing.

- These opportunities include ancillary departments, pharmacies, laboratory control and reporting, word processing, and general office automation.
- Other areas suited for DDP include functions requiring a 24 hour per day operation such as admitting. It is expensive to provide one department with 24 hour per day service from the host computer - unless currently functioning in a 24 hour environment.
- Communications trends are of little importance to most hospitals since they normally hardwire or acquire their own lines. Chain hospitals implementing DDP systems do have significant interest in communications due to the volume of data and high level of transactions that must flow from remote to host and back again.
- Respondents often confused on-line systems with DDP and very few could see any advantage in distributing intelligence in a hospital environment for the processing of standard accounting and patient applications.
- Software packages and turnkey systems are becoming increasingly popular with hospitals - particularly those with less than 300 beds. For many, the concept of being a "remote" where the "host" is a large remote computer services (RCS) vendor such as Shared Medical Systems has great appeal.
- With this approach, the RCS vendor installs DDP equipment from a vendor such as Four-Phase and provides the individual hospital with on-site processing capability for transaction entry, validity and processing, as well as file updating, inquiry and reporting.
- The hospital takes advantage of the RCS vendor's application software and large scale processing capacity periodically through the day and night.

- In fact, one such "remote" indicated significant cost savings and improved service to the user departments by the changeover from in-house centralized computing to an RCS vendor specializing in hospital systems. Commenting that "time is a very precious commodity," a respondent continued, "good customized packages are lots cheaper than an in-house group of general purpose programmers."
- Hospital respondents, when asked what they felt were the positive factors of DDP, answered as follows (in order of frequency mentioned):
 - Improved cost performance.
 - Greater accessibility for the end user.
 - Increased end user involvement.
 - Ease of system expansion.
 - Increased reliability and lower down time.
- Non-DDP respondents, when asked to list the strengths of DDP, replied as follows (in order of frequency):
 - Timeliness of information.
 - Less down time and higher reliability.
 - Move data management to the source.
 - Local control and flexibility.
 - Data handled less frequently - fewer errors.

- The negative factors of DDP as expressed by respondents include:
 - Lack of hardware interfaces; e.g., tying a lab control system to a mainframe.
 - Loss of control.
 - Administrative complexities.
 - More technical support and training required.
 - Lack of multiproduct compatibility and standardization.
- Non-DDP respondents consider weaknesses to include:
 - Loss of central control.
 - End user confusion and extra support requirements.
 - Difficulty of maintaining software.
 - Too costly.
- Small hospitals with under 200 rooms, will find it difficult to justify DDP equipment in addition to a host business system. Larger hospitals may find justification in specific areas such as laboratories, pharmacies and word processing, particularly if the vendor provides applications software and a turnkey system installation.
- Future governmental regulations and intervention may have a substantial impact on the information processing, storage and retrieval requirements in hospitals. This possibility, coupled with the implementation of word processing and report preparation systems, could bring DDP or some other approach to a more important level of acceptance than is currently anticipated.

b. User/Non-User Profiles

(1) What is DDP And How Educated And Experienced Is The Market

- As a service industry, the hospital sector is a strong proponent of the use of EDP in the day-to-day operation of the facility. Almost without exception, every hospital contacted utilized either in-house systems or RCS to perform a myriad of business and patient oriented applications.
- There seems to be no middle ground in terms of the knowledge of DDP in this industry - either a well-developed definition was presented or the respondent claimed ignorance of the subject. Definitions and comments such as the following were received:
 - "A hierarchy of computer resources interconnected by communications networks."
 - "Separate minis doing applications with their data bases tied to central host via communications networks."
 - "Remote processors operating as much as possible on a standalone basis but tied to a host for data collection as well as data base support."
 - "Location of computer equipment in user's area away from host but under host's control."
 - Distribution of both computing functions and data bases."
 - "Off-load from mainframe to small minis via communications hook-up."
 - "Haven't the faintest idea."
 - "What do you mean?"

- The number of valid DDP definitions can be linked to the overall level of DP experience associated with the respondents. Almost one half of the respondents had 15 years or more experience in data processing and none had less than five years in the business.
- There is a common misconception or misunderstanding among non-DDP users in the hospital industry. Many respondents felt that because they had, or were planning on installing, CRTs and printers in an on-line environment they were, or would be doing, DDP.
- There remains some missionary educational work to be accomplished - with both those who erroneously think they understand DDP and those who by admission do not understand it.
- DDP is perceived by the small hospital - with less than 300 beds - as an inappropriate operating philosophy. They feel they are "too small" and that their central batch or on-line system will adequately provide the necessary DP services to the various hospital departments.
- When asked why they would not be planning on installing DDP, respondents replied as follows:
 - "Just finished installing full range of centralized financial systems." (308 beds)
 - "Don't need at a small facility like ours." (180 beds)
 - "Current system handles requirements." (247 beds)
 - "Going on-line with CRTs and printers." (305 beds)
 - "Looking at an on-line system." (300 beds)
 - "All business done in one building." (243 beds)

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- While the organizational structure of a hospital is fairly traditional, the positioning of the data processing department has a strong influence on the acceptance and implementation of DDP.
- Data processing usually has been encumbered by its relationship with the financial department of the organization and has tended toward satisfying the requirements of accounting as a first priority. Those hospital organizations who have moved data processing into a service oriented department reporting to an administrator or other non-financial executive tend toward more utilization of DDP in the overall data processing program.
- Of the nine responding hospitals with DDP planned or implemented, only 33% had the head of data processing reporting through the financial department. This is in contrast with in the non-DDP users who indicated that 82% of them reported directly to a controller or other financial officer.
- Conversely, of those hospitals considering or doing DDP, 66% of the respondents indicated they report to an administrator or other non-financial executive. Only 18% of non-DDP hospitals have data processing reporting to a non-financial executive.
- City and county hospitals implementing DDP also tend to have their top DP officer reporting to a non-financial executive. One respondent, titled Manager of Information Systems, reported directly to the county Director of the Department of Public Health.
- Some hospital department heads have the authority and responsibility to take the initiative in proposing minicomputers to help automate their particular functions.

- One department with access to a large host processor next door in the medical center complex elected to install its own mini to process applications that the host was performing inefficiently and at too high a cost.
- Chain organizations consist of hospitals organized in a traditional way but utilize a centralized approach in managing the data processing resources. Management has the opportunity to utilize DDP in the true sense by removing the need for standalone processors in each hospital and in turn providing them with the required processing functions via a DDP network.

(3) Current And Anticipated Application Structures

- The application structure in hospital data processing is highly oriented around cash and revenue dependent functions and other applications related to the day-to-day operations of the hospital and to the care and of its patients.
- As expected, the following on-site accounting applications, presented in decreasing order of frequency reported, were highlighted:
 - Billing.
 - Accounts receivable.
 - General ledger.
 - Accounts payable.
 - Budget analysis.
 - Payroll and labor distribution.
 - Statistical analysis.

- Among the applications mentioned that were oriented toward patient care and hospital operations were:
 - Admissions and discharge.
 - Laboratory reporting.
 - Automated patient records.
 - Bed availability and census.
 - Patient identification.
 - Pharmacy.
- It is not surprising that general accounting applications rank very high since most hospitals have been utilizing data processing for many years - either in-house with a business oriented computer or via an RCS vendor or service bureau.
- This distinction is important because as DDP is adopted within the industry it is more likely to do so in patient oriented applications as opposed (with exception of billing) to the typical accounting requirements.
- Respondents indicated they were installing or considering DDP for the following applications areas:
 - Medical records and statistics.
 - Admissions and discharge.
 - Laboratory reporting.
 - Billing.

- Automated patient records.
 - Bed availability and census.
 - Patient identification.
- In short, DDP interest is in areas key to the smooth functioning of the hospitals (at high occupancy levels) and to the well being and care of patients.
 - Automation of the laboratory testing and reporting functions is a key area and one in which turnkey minicomputer systems are being installed. Another sensitive area for DDP application development is word processing and office automation.
 - When asked what impact automation of the office would have on the use of DDP, over 77% of the respondents indicated some degree of impact. This compares with a little over 41% of the total respondents who indicated some impact.
 - One respondent commented, "The hospital has many basic clerical typing functions that can be automated - also, there exists significant duplication of data and information."
 - Another respondent indicated the hospital would be utilizing their mini for word processing and report writing within the next six months. Doctors will dictate and data will be entered by secretaries in an on-line manner to the minicomputer.
 - Hospital laboratories and ancillary departments are finding more reasons to implement mini systems - primarily to automate department functions and secondarily to communicate data and patient information to the host.
 - Finally, areas that are staffed around the clock are candidates for DDP. Admitting is a 24 hour per day operation. If it had its own mini or DDP system, admitting could be automated without requiring the host to be staffed around the clock.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The justification for the adoption of the DDP approach in those hospitals planning or actually implementing the system should be more appropriately entitled "How did DDP come to be?" No two hospitals surveyed utilized the same methodology and none applied detailed cost/savings analysis.
- There appear to be three key phases involved in examining, approving and installing a DDP system. The first phase is the evolution of the DDP concept as a DP solution. The following interview responses are provided for illustration:
 - Vendor initiated. (Host)
 - Default - mainframe could not support 1,000 terminals. (Host)
 - Steering committee looked at feasibility. (Host)
 - Concern over high recurring costs. (Host)
 - Review by long range planning committee. (Remote)
 - Dissatisfaction with host support. (Remote)
 - Hardware offered as pilot project. (Remote)
- Once the DDP concept was formulated, the next step in the proces was to justify the cost and projected savings to the appropriate authority. Again, as there were many different forms of initiation of the DDP approach, there are as many different methods of justification procedures utilized by the respondents. The following justification procedures were highlighted during the interviews:

- Internal analysis. (Host)
 - User references. (Host)
 - "Had to do something." (Host)
 - Cost/savings analysis. (Host)
 - Review by financial steering committee. (Host)
 - Analysis of RCS and hardware vendor offerings on cost/benefit basis. (Remote)
 - Easy implementation. (Remote)
- Finally, while the initiation and justification methodology varied widely, the final decision making authority was a financially oriented executive or committee. Both host and remote respondents indicated the financial department or hospital administrative department was the decision maker 60% of the time.
 - The following were identified as individuals or groups having final decision making responsibility for DDP proposals:
 - Board of Trustees.
 - Financial Director.
 - Director of Finance.
 - Purchasing Agent.
 - Owner.
 - Vice President Finance.

- Technical Committee.
- The non-adoption of the DDP concept can only be interpreted from the comments of the telephone respondents. While they all utilized data processing via an in-house equipment or RCS, their comments as to why they did not select the DDP approach points out their potential lack of knowledge of DDP coupled with higher personal priorities:
 - "Could not ever cost justify on-line let alone DDP."
 - "No need."
 - "We're looking at an on-line system."
 - "No need for intelligence at various stations."
 - "Too small."
 - "Can't afford the dollars, space, staff and headaches."
- When asked what must happen for them to consider or re-assess DDP, the same group responded:
 - "Be totally convinced of cost justification."
 - "Won't."
 - "Don't know."
 - "Buy another hospital."
 - "Change in administration."
 - "Be totally convinced that DDP would be less expensive in hardware and software than a central on-line system."

- In summary, DDP justification and adoption procedures are mainly in the eyes of the beholder. While there are numerous means by which the DDP concept originates in hospitals, the ultimate sign-off and approval comes from the financial executive.
- Although many justifications methods were presented, the major concern is toward insuring that the costs of the DDP installation (including hardware, software, training and communication) are off-set by hard dollar savings and significantly improved user information.
- While the respondents did not quantify cost savings, they did indicate the various operations that DDP replaced or eliminated. These included:
 - Batch.
 - Manual systems.
 - Batch data entry.
 - Upgrading the host.
 - Courier delivery services.
 - Excessive telephone usage and cost.
 - Hardware controller.
 - Centralized DP.
- Neither host nor remote respondents were able to quantify the cost of pre-and post-DDP processing methods. This indicates that once a decision to implement DDP has been reached, there seems to be very little done to check and quantify actual cost/savings and benefits to the user.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- With the exception of the chain hospital, communications requirements are not a significant function or factor in the DDP environment. Standalone hospitals have a known physical size with extremely short distances over which to communicate. This enables the hospital to install its own lines and to hardwire one system to another.
- As a whole the hospital industry indicated little concern over the impact that trends in communications would have on their use of DDP. Only 44% indicated a minimal, major or some degree of impact. This compares to over 69% for the general sample. Conversely, 56% of the hospital respondents indicated that communications trends would have no impact on DDP. This compares with only 25% of the total respondents who so indicated.
- When asked his concern over communications, VANs, etc., one respondent said, "We are so local we will not be affected by it."
- Additionally, when asked about DDP communications concerns, half the respondents answered "none" or "cost." Several respondents did not understand what Value Added Networks (VANs) were.
- There was little concern voiced by the respondents concerning down time and the length of time the host and remote could be uncoupled. Host and remote respondents had consistent replies on this issue. Over 75% said they could be uncoupled for 16-24 hours while only 37% of the general sample gave the same answer.
- The minimum loss of host/remote interface indicated by a hospital respondent was 5-10 hours at a remote site while at the host site an 11-15 hour period was allowable. This contrasts with over 16% of the general sample who indicated 5 hours or less was the minimum time for disruptions regardless whether of host or remote operations were involved.

- The hospital chain operator has a much higher concern over trends in communications and feels that improvements in such communication vehicles as VANs will significantly increase the use of DDP.
- The chain operator's major concern today is the quality, availability and cost of high speed data communications. With significant quantities of data to transmit, communications costs are of great concern.
- This chain user's greatest concern involving DDP communications is the ability to maintain the reliability, availability and serviceability of the data at the remote hospitals. Yet even this user feels that his central and remote systems can be uncoupled between 12 and 24 hours.
- In the area of distributed data bases there are significant differences among respondents irrespective of host or remote. While 66% of the respondents answered "yes" to the question of "will data bases be distributed," when questioned further, they said that data bases really meant information or simply data files.
- Most respondents talk of distributing data and files in order to provide information rather than true data base distribution and management. In fact one respondent with over 10 years of data processing experience said, "I have not seen a software product that allows effective distribution of data bases."
- Estimated file sizes at the user location ranged from 1.2 million bytes to over 400 million bytes depending upon volume, application and size of facility. Typically, respondents mentioned the following as possible distributed files:
 - Patient.
 - Doctor.
 - Pharmacy.
 - Clinic.

- Research.
- Materials.
- Respondents indicated overnight back-up and transmission to host for processing and organization with a down-loading of data to the remote users as a day-to-day operating philosophy.
- From the respondents' viewpoint, there is much to be accomplished in terms of true data base management systems. For the present, users seem resigned to working with data in various files according to the needs of the end user. However, the majority of respondents feel data must be distributed in order to adequately service the information requirements of the end user. To this extent, as much disk storage as necessary will be supplied to the DDP system. Yet overall, respondents indicated little thought or planning had been given to the methodology and frequency of synchronizing data bases.

(6) Vendor Characteristics For Getting And Keeping DDP Business

- When asked what the single most important factor in selecting a DDP vendor was, the overwhelming response was equipment reliability and maintenance capability. Remotes indicated that the ability to turnkey the installation was also very important.
- Equipment cost/performance and the vendor's reputation are not nearly as critical in the decision making process as are the reliability and maintainability of the equipment.
- The importance of these key elements was reinforced when the respondent was provided with a list of factors to rank in terms of overall importance in selecting a DDP vendor.
- The following are factors considered critical or very important by 50% or more of the respondents in the decision to choose a DDP vendor:

- Product reliability.
 - Maintenance.
 - Product price/performance.
 - Available language.
 - Application software.
 - Compatibility of software.
 - Compatibility of hardware.
- The hospital industry in general regards the following factors as relatively unimportant in the DDP vendor selection process:
 - Vendor image.
 - Ease of training.
 - Volume discounts.
 - Terms and conditions.
 - One stop hardware shopping.
 - Availability of network interconnect with software.
 - The vendor providing the hospital industry with DDP application software as a package or on a turnkey basis is somewhat more likely to be successful in achieving and retaining the DDP equipment business. While 33% of the hospital respondents selected the vendor for software, only 25% of the total general sample did likewise.

- Forty-four percent of the hospital respondents indicated they would develop the software in-house vs. 72% of total respondents. Twenty-two percent of hospital respondents prefer a package or would go in-house if no package was available as compared to 11% of the total.
- Additionally, the remote respondents rated application software and turnkey services as the most important criteria in the selection of a DDP vendor. When asked to state the most important vendor selection criteria, one remote respondent said, "Finding a software/applications package that meets most of the user's needs at a reasonable cost."
- When considering programming language requirements, a vendor offering a variety of languages will have a broader appeal to the hospital DDP marketplace. While 62% of the total respondents asked for COBOL, only 33% of the hospital respondents had the same request. Among the languages additionally desired were:
 - BASIC
 - FORTRAN
 - RPG
 - ASSEMBLER
 - PL/I
 - MUMPS
- The hospital industry's overall satisfaction with DDP ranks higher than does that of the total general sample. In fact, 100% of the remote respondents rated DDP as either outstanding or very good. Sixty-six percent of all the hospital respondents said outstanding or very good as opposed to only 50% of the general sample.

(7) The Future For Remote And Host Participants

- It is possible to define several different types of remote users in relation to the host.
- In the standalone proprietary hospital, the remote user will normally be an ancillary department. This hospital may also view itself as a remote when serviced by an RCS vendor supplied host. This approach seems to be becoming increasingly popular based upon the number of telephone discussions INPUT conducted with hospitals indicating current or planned use of RCS with in-house DDP equipment.
- A second type of "remote" results when a city or county hospital utilizes the central DP facilities of the city or county data center. Typically, the hospital will operate in an on-line environment with opportunities for DDP in areas having to do with patient care.
- The third type of remote is more typical of the usual example - the chain hospital operation. Here the opportunity for DDP is substantial since all applications normally associated with in-house central business systems and patient care can be developed into a DDP network.
- DDP decisions in chain hospitals are projected to be made centrally through the corporate data processing and financial departments.
- With the standalone hospital DDP will not replace currently planned or installed on-line centralized systems. However, there is an excellent opportunity to market the DDP concept to the "remote" user whose department currently receives little or no support from the central data processing operation.
- As a result of poor service received from the host, the radiology laboratory of one facility installed its own mini to better service the laboratory and its patients. At some time in the future, the mini will communicate electronically with the host processor. Currently magnetic tape is the data transfer media.

- The major area of confrontation at remote locations will be as a result of the host's desire to serve the user via on-line "dumb" terminals.
- A negative factor impacting the potential of DDP is the continuation of the present lack of standardization. One-third of all hospital respondents consider this a major factor that will serve to decrease the potential for DDP.
- Key to the success of implementing DDP systems in remote locations is the identification and development of applications not easily processed directly by the host or centralized computer system.
- Providing turnkey services for user department DDP installations will be a more successful vehicle for implementing DDP than relying on the hospital's main data processing staff of analysts and programmers.
- Finally, significant competition will continue from RCS vendors offering well developed software, processing power and communications networks. This type of host processing capability has an increasing appeal to the many standalone hospitals concerned with rising in-house hardware costs and related personnel expenses.

10. CITY AND COUNTY GOVERNMENT

a. Overview And Conclusions

- City and county governments have long been proponents and significant users of data processing equipment and services. However, this market, in INPUT's opinion, does not represent the same proportional capacity for the development and installation of DDP equipment and services.
- The city or county is a geographically well defined and physically restricted entity. User departments and public services, including data processing, are often housed in one physical facility.

- These characteristics have led to the development of data processing services as a centralized on-line philosophy where users are frequently physically co-located with the host computer(s).
- As a result of this evolutionary development of centralized data processing services, INPUT believes DDP will have a difficult time replacing installed functions and hardware.
- Yet an opportunity and marketplace for DDP still remains although somewhat limited to areas not significantly impacted by or easily implemented on the host computer. Examples are in police and fire dispatching systems.
- Applications with software oriented around minis, such as library book and circulation control, are also potential candidates for DDP.
- Additionally, the requirement for RFP's and bids on equipment procurement significantly lengthens the "sell" cycle and impacts the chances of obtaining the business since the lowest qualified bidder normally receives the award.
- Respondents were well educated in terms of their awareness of DDP and their ability to succinctly offer a workable DDP definition.
- Thorough understanding of the user requirements and the bid procedures are critical factors in developing DDP business.
- Respondents do recognize there are benefits in installing DDP. When asked to articulate the positive factors of DDP, they replied (in order of frequency mentioned):
 - Reduction in mainframe usage.
 - Cost and price performance.
 - Increased end user involvement.

- Non-DDP users when asked to highlight the strengths of DDP replied similarly:
 - Move data management to the source.
 - Off-load the mainframe.
 - Local control and flexibility.
- Significantly, only one non-DDP respondent felt reduced cost was a benefit.
- Negative factors of DDP as stated by the respondents included (in order of frequency mentioned):
 - Administrative complexities.
 - Loss of control.
 - Communications dependencies.
 - Lack of multiproduct compatibility.
 - High start up costs.
- Similar concerns were voiced by the non-DDP respondents when asked to highlight the weaknesses of DDP:
 - Loss of control.
 - Too costly.
 - Administrative complexities.

- Overall, DDP has yet to prove itself in city and county government operations. There are excellent, but limited, DDP opportunities for those vendors willing to write a turnkey contract for installation of hardware and software.
- One very experienced respondent stated, "I feel DDP is just a promotion for manufacturers to move hardware."
- DDP is just in its infancy as far as city/county government respondents are concerned. Its sensitivity is not well developed at this time.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- City and county governments have been users of data processing systems for serving the needs of the population and governmental departments. Every INPUT telephone contact found data processing equipment installed.
- However, city and county governments are geographical entities and have extremely limited possibilities for physical expansion. As such, governments have tended to develop the use of data processing from a very strong centralized perspective and have oriented systems toward on-line, data base operations.
- The concept of DDP is not new in the local government market. It appears to be extremely well understood by both DDP and non-DDP respondents regardless of population size as illustrated by the following definitions that were offered:
 - "Distribute data access and processing services to outlying areas via telecommunications."
 - "Distribution of the processing functions out to remote locations but with a connection back to the host processor or system."

- "Interconnection of local processors."
 - "Central mainframe connected with network of minicomputers (intelligence) at remote locations."
 - "Transfer of functions from host downline to smaller processing units having limited storage so that a significant number of transactions can take place downline - yet can get back to host for data base requirements and processing."
- The high level of DDP awareness is a measure of the respondents' years of experience in data processing. Over 63% indicated 15 or more years in DP while only 46% of the general sample so indicated.
 - Additionally, the least experienced government respondent reported 7 years of experience in data processing.
 - Over 62% of the non-DDP respondents had 15 or more years of DP experience while only 17% of the general non-DDP sample reported such a high level of experience.
 - All of the non-DDP government respondents had 9 or more years of data processing experience while only 75% of the general non-DDP sample had as much experience.
 - Yet with such a high level of data processing experience, few city/counties interviewed have implemented DDP systems. With the exception of one city, no government with less than 250,000 population that was interviewed had installed DDP. The one exception had installed a police Computer Assisted Dispatch system and linked it to the main city computer.
 - Two entities with populations of over 250,000 had installed DDP for one or more applications.

- Few city/county governments under 250,000 population were considering or planning DDP installations. Reasons given varied but most respondents felt that the central facility or an on-line system would satisfy users.
- The following comments were given in response to why the city or county was not using or anticipating DDP approach:
 - "Central system has enough power to handle immediate and future requirements."
 - "No justification."
 - "On-line system meets current and anticipated requirements."
 - "On-line is better for the small city relative to widely dispersed distributors, manufacturers, etc."
 - "No justification - we can handle all city processing requirements centrally."
- Those enterprises having implemented a DDP system have done so for very specialized, minicomputer oriented applications such as:
 - Computer Assisted Dispatch.
 - Solid waste land fill control.
 - Hospital processing.
- Although the DDP concept is well understood in city/county governments, the overall experience level is very low. This is fundamentally as a result of the many years of development around the centralized, on-line data base approach to satisfying user data processing requirements.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- Organizationally, city and county governments are very similar in structure. Typically, the top data processing manager or executive reports to a city manager, chief administrative officer or financial executive.
- These executives in turn normally report to a city council or county board of supervisors who ultimately are responsible to the voting public.
- The data processing decision making function is primarily controlled by the city county central data processing organization. In no case was a department or user group allowed to make its own decision on a DDP installation independent of involvement by the DP department.
- This process is confirmed by the respondents with over 87% indicating strong central control over both systems development and equipment procurement. This philosophy is closely aligned with the sentiments of the general DDP sample.
- Additionally, strong central control is evidenced by the fact that over 62% of the DP respondents indicated that the central data processing department absorbs most or all of the enterprise's DDP expense as opposed to only a reported 34% of the total sample.
- In short, the top data processing manager or executive is a very powerful individual and can significantly influence the direction data processing, and therefore DDP takes in the governmental organization.
- As a result, most DP Directors initially evaluate a user's request for a DDP system based on whether his central mainframe can satisfactorially provide the solution. If not, then he will normally participate with the user in the DDP development process.

- This methodology has led to the development of on-line systems and data bases and the propagation of "dumb" terminals throughout city and county operating departments.
- DDP solutions to user requirements have been limited to those application areas not suited to host processing such as Computer Assisted Dispatch systems for police departments.

(3) Current And Anticipated Application Structure

- The application structure in city and county data processing is two-fold. First, are those typical accounting applications common across most industries. They are, in decreasing order of frequency mentioned:
 - Budget administration.
 - Accounts receivable.
 - Accounts payable.
 - General ledger.
 - Inventory.
 - Personnel records.
 - Math/statistical analysis.
- Second, are those applications typically associated with local governmental requirements. They are in descending order of frequency mentioned:
 - Revenue accounting.
 - Taxing.

- Licensing.
 - Traffic citation processing.
 - Appropriation accounting.
- It should be noted that a wide variety of city and county applications were mentioned that did not easily fall into specific classifications. These specialized functions ranged from law enforcement support to building permit issuance and inspection scheduling.
 - Respondents discussed and reviewed a wide range of applications designed and developed to help the many departments provide better services to the general public. One respondent stated his overall philosophy as, "Making services more convenient to the public" ... - and he has attempted to do so via an on-line processing philosophy.
 - Only 32% of the respondents reported any tie-ins with other event driven or office operation systems. These tie-ins were in the area of text processing applications.
 - Additionally, several respondents indicated tie-ins with major county, state and national law enforcement systems.
 - The applications for DDP were limited since only three cities or counties had it installed. These DDP areas were police dispatch, landfill monitoring and hospital processing. Respondents did indicate that in addition to the above, the following were under consideration for DDP:
 - Library circulation.
 - Fire dispatch.
 - Court system.

- Assessor/property appraisal.
 - Licensing.
 - Revenue accounting.
 - Budget administration.
 - Traffic citation processing.
- Interestingly, the above replies were among those provided by non-DDP respondents when asked for what key applications they would next evaluate DDP.
 - Respondents indicated overwhelmingly the need for application software and more importantly turnkey efforts for DDP installations in user departments. Seventy-five percent said they wanted a package or a turnkey contract from the vendor.
 - There appears to be opportunity for DDP in the office automation environment -and more specifically word processing. When asked about the impact upon DDP of increasing the automation of the office, one respondent indicated "major" and further said, "Have to do something - government today is a paper mill!"
 - On the same question, a second respondent commented, "Currently, there is not a good way to address word processing from the central CPU viewpoint."

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The justification and vendor selection procedures are basically identical from one city or county to the next.

- Normally, a user department initiates a request for data processing services and a technical feasibility study or analysis is performed by the most data processing staff. Finally, the DP Director or his staff determine if the user requests can be satisfactorily implemented on the central host or whether a DDP solution is really more practical.
- Cost justification is a very sensitive procedure and most city/county organizations have a formal justification technique that is applied to any data processing consideration.
- Regarding justification one respondent replied, "Development costs must be recovered in three years and the on-going DDP costs must be less than displaced costs."
- The respondents mentioned cost/benefit as a justification procedure 88% of the time while the general sample responded with the same reason 66% of the time. Staff saving was mentioned 25% of the time in city/county justification procedures vs. only 6% of the time by the general sample.
- After a thorough and formal cost justification process, RFPs are issued to vendors. Vendor selection is usually made by selecting the lowest priced qualified respondent. A contract is then negotiated.
- The negotiated contract is crucial in obtaining the DDP business. The top local government data processing executives usually do not want the responsibility for managing or installing the DDP system.
- As such, they will write a complete performance oriented contract for a turnkey system with the selected vendor. One respondent said, "Six months expired from the time the vendor was selected to the signing of the final contract."

- The respondents indicated the following as methods or processes that DDP did or would replace:
 - Batch processing.
 - Manual methods.
 - On-line data entry.
 - Key punch.
- Direct selling to the end user or to the data processing department of city and county governments is becoming more and more time consuming and frustrating.
- The requirement for bids on almost all procurements for data processing or DDP compounds the marketing effort. Even after successful selection in a bid process, the vendor must then be prepared to negotiate a contract with the city or county.

(5) Distributed Data Base And Communications - Trade-Offs And Trends

- With few exceptions, the subject of communications is not an issue of major concern by city and county data processing departments as it relates to DDP. Cities and counties have a fixed physical size and have very short distances over which to communicate. Leased lines are not expensive.
- Only 37% of the respondents indicated that communication trends would have some or a major impact on DDP. This compares to almost 50% of total respondents answering in the affirmative.
- The major exception is in the area of law enforcement systems. The computer assisted dispatch facility and the link of city and county systems to the state and federal networks requires fast response times and an extremely high level of up time.

- When asked what impact communication trends would have one respondent replied, "Not with us - we operate in a 40 square mile area."
- With the exception of law enforcement systems users who said they could be uncoupled only momentarily, respondents indicate little concern over the need to keep the remote and host coupled together.
- Half the respondents said they could be uncoupled for 16 hours or more.
- No respondent had yet to distribute data bases downline to a DDP system and only 37% indicated they would do so. Of the total general sample, 62% plan to distribute data bases.
- Plans on how data and files would be distributed are very vague with some users looking to the vendor for supporting software. One respondent, said, "Presently, no vendor offers software that will distribute data bases downline and the human effort by my staff would be just too much work."
- File requirements at the DDP locations ranged from 5 million bytes to over 300 million bytes depending upon the distributed applications.
- Respondents indicated little thought or planning had been given to the methodology and frequency of backing up and synchronizing data bases and data files.

(6) Vendor Characteristics For Getting And Keeping The DDP Business

- When asked what the single most important factor in selecting a DDP vendor was, the overwhelming response was equipment cost or equipment price performance.
- The only other response mentioned more than 25% of the time to the same question were concerns over equipment reliability and the reputation of the vendor.

- One respondent summed up the feelings of several DP directors on the subject of the greatest motivation for going to DDP when he said, "The lack of adequate hardware and software to economically address the "problem."
- If the application cannot be implemented through the host facility then the vendor's opportunity rests in offering an integrated hardware and software turnkey installation package - at a price low enough to be selected in competitive bidding.
- A vendor's turnkey capability was heavily emphasized by one respondent when asked about the most important criteria for success of DDP in government:

"The capability of vendors to turnkey the complete DDP installation - this requires the vendor to really understand the expectations of users in order to successfully install hardware and software."

- Therefore, vendors must look to city and county user groups whose application requirements are not easily or practically satisfied via the host processing system.
- Such application areas would include:
 - Police dispatch control systems.
 - Fire department dispatching.
 - Library book and circulation control.
 - Landfill management systems.
 - Order entry/financial analysis.
 - Engineering/mathematical analysis.

- Rated as critical or very important to the selection process by 100% of the respondents were product price/performance and product reliability. Interestingly, the total general sample responded 66% and 86% respectively.
- Other factors considered as critical or very important by 50 percent or more of the respondents were in descending order of frequency:
 - Maintenance.
 - Ease of training.
 - Compatibility of hardware.
 - Language availability.
 - Compatibility of software.
 - Vendor image.
 - Application software.
- One respondent when asked for any additional factors ranked "require turnkey installation" as critical and more important than any other listed factor.
- Factors rated as basically unimportant by the respondents in the DDP vendor selection process were:
 - Volume discounts.
 - Terms and conditions.
 - One stop hardware shopping.
 - Network interconnect with software.

- When considering programming languages a vendor offering one or more of the following, ranked in order of preference, will meet the requirements of the city and county governments:
 - COBOL (by far the most often mentioned).
 - BASIC.
 - FORTRAN.
 - RPG.
 - PL/I.
- Vendors should be aware that there is significant demand to increase the level of hardware and software compatibility. Seventy-five percent of city/county data processing respondents said it would have a major or some degree of impact on DDP.
- This correlates with the 63% response from the total general sample who so agreed.
- Once equipment is installed in government, it tends to stay installed and therefore is less susceptible to competitive replacements.

(7) The Future For Remote And Host Participants

- The remote site in city and county government is usually a user department which may be as close to the host as across the hall or as far away as across town. The remote user is significantly impacted by the host or central data processing operation in the development of a DDP system.

- Because the host's charter normally includes providing all city or county data processing services regardless of location, all new requests are typically reviewed by the host DP group.
- Every effort is initially made to try and apply the host's processing capabilities to the user's needs or requests. Only after host processing is determined to be impractical are alternative solutions such as DDP investigated.
- All equipment procurement is normally via the RFP and bid route. Since remote users have little data processing expertise they are forced to rely on the host resources to develop the bid specifications and to evaluate the responses.
- This host/remote relationship is certainly not expected to change within the forecast period of this study.
- The requirement for bidding on equipment procurements is not anticipated to change. If anything, the complexities will increase over time as more items will require a bidding procedure.
- The growing operating constraints imposed by legislative action at the state and federal levels are of concern to the DDP environment and overall data processing operations of city and county government.
- Over 60% of the respondents feel that these constraints will have a major or some degree of impact on DDP. Appropriately, one respondent concerned over the growing restrictions on privacy and file processing stated, "I could catch all welfare cheaters if we (various government agencies) could compare files."
- Word processing and automation of the office are areas where the remote user may find and implement a DDP approach.

- To date, there has been little experience with DDP in city and country government. This low level of activity accounts for a below normal rating in terms of the respondents' feelings on the overall satisfaction level with DDP.
- City and county data processing departments provide services to a wide range of user departments in response to public needs. These services have been developed from a centralized, on-line processing philosophy.
- This operating philosophy has been most successful and there is little evidence to support a change.

II. MOTOR FREIGHT

a. Overview And Conclusions

- The motor freight industry is almost totally uncommitted to any form of DDP. However, a number of companies have developed and installed sophisticated on-line or RJE types of systems.
- Five of the seven non-DDP respondents had on-line systems installed with as many as 225 terminals that were interactive with a host processor.
- The attitude of many respondents can be summarized by the statement of one non-DDP respondent when asked why he was not planning on developing DDP with communications, said, "This industry doesn't need it and if you knew anything about this business you wouldn't ask that kind of a question!"
- Both remote interviews provided very little data - so little that no conclusions dealing with remotes can be made. However, INPUT concludes that marketing and sales efforts at the remote level will yield little or no return on this investment.

- One very large carrier is installing DDP in his manufacturing operations; not his motor freight facilities!
- DDP will have a difficult time replacing the sophisticated on-line systems now installed. Only two of the non-DDP respondents indicated they would evaluate DDP prior to 1985.
- When asked to articulate the positive factors of DDP, the respondents listed the following:
 - Timeliness of results and increased throughput.
 - Greater accessibility to information for the end user.
 - Cost performance.
 - Improved reliability.
- Non-DDP respondents when asked to highlight the strengths of DDP said:
 - Local control and flexibility.
 - Timeliness of information.
 - Off-loading host mainframe.
 - Reduce costs.
- Alternately, negative DDP factors are:
 - Compatibility with host.
 - Loss of control.
 - Too expensive.

- Communications oriented problems.
- Non-DDP respondents listed the following when asked the weaknesses of DDP:
 - Loss of central control.
 - Too expensive.
 - Increased support requirements.
- Data processing personnel feel very strongly that DDP will cost too much and result in the loss of control of the data processing function.
- Government regulation is not expected to impact DDP. All respondents said constraints by government would have minimal or no effect on DDP. One respondent said, "We are already burdened with all we need."
- Perhaps the greatest opportunity for DDP in the motor freight industry can be summed up in the statement from one individual in discussing his future plans for DDP who said, "I would like a microprocessor system in every truck!"

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- As an industry, motor freight significantly utilizes data processing for day to day operational requirements. However, the use of and experience with DDP is extremely low. Only one company had actually implemented a DDP network.
- A second company had plans to do so within the next six months. Others appear to be years away.

- Yet the definitions of DDP indicate more than a passing knowledge of DDP:
 - "Putting input and output where the user is, more or less synonymous with telecommunications."
 - "Any DP activity where the user of information has a key role or control of the source or processing of the data."
 - "Doing various processing functions via minis, etc. remote from the central computer yet with a link to it."
- All non-DDP respondents provided very good DDP definitions with one exception.
- Neither of the two remote site DDP respondents could give any definition of DDP.
- The experience level among data processing management is quite high - 75% have 9-10 years or more of EDP experience.
- Non-DDP respondents also indicated a high level of EDP experience with all but one reporting 12 or more years in data processing.
- Comments from non-DDP respondents on why DDP with communications was not being considered included:
 - "We are not into that - we're doing just batch."
 - "No management commitment and cannot cost justify."
 - "Do not want to relinquish control of intelligence to remote sites."
 - "We are currently committed to an on-line approach."

- While apparently knowledgeable in data processing, the motor freight industry is very inexperienced in DDP although respondents do understand the concept.
- It is unlikely that the DDP experience level will increase over the next few years.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- As there has been little implementation of DDP, it is difficult to assess accurately the impact of management organization on its development.
- All major corporate accounting and control applications are processed centrally.
- Data processing resources are a corporate asset normally residing at the headquarters location.
- Applications and systems development is centralized and no change in this philosophy is likely.
- All decisions concerning data processing and equipment procurement are made at the corporate level. The top data processing executive has a great deal of authority and reports to either a financial or administrative executive or committee.
- The strong centralized DP operating philosophy has served to substantially hinder the development of DDP and at the same time promote the concept of on-line data base management systems.

(3) Current And Anticipated Application Structure

- The on-site host application structure is two-fold. The first is the typical accounting function with the following applications listed in descending order of frequency:

- Accounts receivable.
 - General ledger.
 - Payroll and labor distribution.
 - Accounts payable.
 - Sales analysis.
 - Billing.
- Secondly are the industry oriented and on-site applications that half of the DDP respondents indicated were automated:
 - Freight bill entry.
 - Interline payables.
 - Shipment analysis.
 - Owner operator accounting.
 - Rate analysis.
 - Equipment inventory.
- Key applications for DDP consideration mentioned by half or more of the respondents are:
 - Billing.
 - Accounts payable.
 - Inventory control.

- Payroll and labor distribution.
 - Sales analysis.
 - Accounts receivable.
 - Shipping analysis.
 - Freight bill entry.
- Word processing and the automation of the office are perceived as insignificant in terms of their impact on DDP. Seventy-five percent responded they would have no effect on DDP as compared to only 28% of the total group who responded similarly.
 - None of the respondents reported any tie-ins with event driven or office automation systems. This parallels the responses of non-DDP respondents in motor freight who also indicated no tie-in systems in their installations.
 - Seventy-five percent of the respondents indicated DDP software would be developed in-house.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The major reason for consideration of the DDP approach in motor freight is to improve the flow of information to and from remote freight terminals. When information began taking three days to reach headquarters, one company initiated a search for a more productive communication methodology - and DDP became the vehicle selected.
- In one case the President seemed to be the driving force behind initiating a DDP analysis. This resulted largely from his concerns over efficiency and productivity.

- Little else was mentioned by respondents as to why they investigated DDP.
- Justification techniques included formal cost benefit analysis, ROI analysis and intangibles such as "improved management control."
- All decisions on DDP equipment and vendor selection were made at corporate headquarters by data processing executives after general approval by the company's top financial management.
- Data processing expenses including DDP are absorbed at the corporate or divisional level.
- It does not appear that a formal vendor or equipment selection process is required by corporate management - no respondent indicated a need for RFPs or other structured approaches to equipment procurement.
- The respondents indicated the following as methods and processes that DDP did or would replace:
 - Manual methods.
 - Centralized processing.
 - None - new application or procedure.
- Based upon information supplied from non-DDP respondents, it is unlikely that they will seriously initially consider or reconsider the DDP philosophy. When asked what must happen for them to consider DDP they commented:
 - "A significant change in attitude of management must happen." (\$97 million)
 - "Significantly reduce personnel costs." (\$120 million)
 - "Be convinced it is the best way to run my business!" (\$120 million)

- "They would have to fire me first! There is just a freight terminal out there - why do we have to put a computer into it?" (\$200 million)
- "Be able to totally control systems and programs from a central location." (\$260 million)
- It is apparent that prior to justifying the DDP approach data processing management attitudes toward DDP must be realigned.
- All respondents indicated software and systems development would be accomplished centrally for both current and planned applications.

(5) Distributed Data Base And Communications - Trade-Offs And Trends

- Communications is an important factor for those respondents who have or are immediately planning on implementing a DDP network.
- When asked what impact communication trends such as VANs would have on DDP, 50% said major while only 27% of the total sample so responded.
- Freight bill entry is the key communications oriented application from the respondents experiences.
- Down time is a major concern. One respondent indicated that he must switch to a cumbersome manual method after 5 minutes. Another said 3-4 hours was the maximum allowable down time.
- However, one respondent indicated 16-24 hours of down time was workable since his remote locations are only polled once a day.
- Communication concerns as viewed by the respondents included:
 - Reliability of the network.

- Maintenance by the phone company.
- Error free transmission.
- No single individual respondent had or was planning on distributing data bases down line. One respondent said if communication costs continue to increase he would move a subset of the data base down-line to his largest remote locations.
- The majority view of respondents is that data bases are not required at remote locations.
- One respondent indicated he might require 10-15 million bytes of storage at his large remote sites.
- Respondents indicated little thought or planning had been given to the methodology and frequency of backing up and synchronizing data and data files.
- Overall there is very little knowledge of data base and data base management systems in motor freight based upon the responses of four data processing executives interviewed.

(6) Vendor Characteristics For Getting And Keeping The DDP Business

- Half the respondents indicated that an equipment maintenance capability was the most important factor in their selection of a DDP vendor. Other factors mentioned included:
 - Equipment cost/performance.
 - Vendor reputation.
 - Compatibility with existing hardware.

- Software capability.
- One respondent said "work simplification" was the single greatest motivation for going to DDP. Other comments included:
 - Timeliness of information.
 - Move data management and control to source.
 - Flexibility for the end user.
 - Better customer service.
- Rated as "critical" or "very important" to the vendor selection process by 100% of the respondents were:
 - Product reliability.
 - Maintenance.
 - Compatibility.
- Other factors considered "critical" or "very important" by 50% or more of the respondents were (in descending order of frequency):
 - Price performance.
 - Vendor image.
 - Compatibility of software.
 - Availability of network interconnect with software.

- Rated as unimportant in the DDP vendor selection process were:
 - Volume discounts.
 - Special terms and conditions.
 - One stop hardware shopping.
 - Language availability.
 - Application software.
- The following are programming languages ranked in descending order of preference:
 - COBOL (mentioned by all respondents).
 - PL/I.
 - FORTRAN.
 - ASSEMBLER.
- Improved standardization in DDP would be a strong selling point for vendors. One hundred percent of the respondents said that the continuation of the present lack of DDP standardization will decrease their consideration or use of DDP.
- The need to increase hardware and software compatibility is not seen as an important influence or factor in the consideration or implementation of DDP by the respondents.

(7) The Future For Remote And Host Participants

- There has been very little solid experience with DDP in the motor freight industry. No evidence surfaced to indicate that this will change in the near future.
- Remote locations are primarily freight warehouses run by a foreman or manager with no data processing experience.
- Any DDP decision (and few have been made) originates at the host location and the end user has or will have limited input on equipment selection or application development.
- The motor freight industry has developed data processing from a centralized philosophy. Sophisticated teleprocessing systems have been and continue to be installed to provide headquarters with appropriate management information.
- With this overriding barrier the adoption of distributed data processing within the forecast period appears extremely limited.

12. COLLEGES

a. Overview And Conclusions

- The college sector is currently foremost in its understanding and use of DDP, and has had several years of experience with DDP.
- Intellectual curiosity, an appreciation of cost/effectiveness benefits and the availability of federal grant funding, have all been driving forces toward DDP.
- Both at the junior and senior college level, DDP has been employed for a variety of student (educational) work and for administrative management.

- Many schools are in the process of upgrading their current DDP installations to a "second generation" level offering greater sophistication and capacity.
- This "second generation" is being funded primarily internally, rather than with outside (federal) funds. It is based on recognition of improved cost effectiveness through the use of more sophisticated technology accompanied by a reduction of communication costs.
- This trend is expected to continue over the next 5-8 years but should slow somewhat toward the end of the period as a saturation point is reached.

b. User/Non-User Profiles

(1) What Is DDP And How Educated And Experienced Is The Market?

- INPUT currently ranks colleges first of all surveyed industry sectors in their sophistication and length of experience with DDP.
- Respondent definitions of DDP emphasize placing computer resources as close as possible to the user while retaining control of the large-scale data base and benefits of the speed/power performance capabilities of the host mainframe.
- One user defined DDP as the "functional distribution of computers to maximize functional economies and specialization while minimizing technical barriers for computing access - all to bring the level of computing down to that of a tool."
- Network structures are hierarchical or hybrid in nature and show a greater facility for managing intricacies to achieve more efficient and effective organization.
- Job structures typically supported include a broad mix of on-line, batch, RJE, and timesharing applications using multiple languages and data bases.

- On average, DDP respondents were somewhat below other sectors in length of experience in EDP (10+ years). However, more than 3 years of this total has been in DDP.
- Some schools have been doing DDP for as long as 5-6 years.
- In summary, colleges appear to be an experienced and relatively mature DDP sector. Those schools that are not doing DDP now expect to be doing it within 2 years or as soon as their budgets can be approved. Colleges which began DDP early are already beginning to replace, upgrade, and reconfigure their networks to provide greater capabilities at lower costs.

(2) Impact Of Management Style And Organization Structure On DDP Implementation

- Colleges exhibit a more participative and democratic structure in their DP control and management than do most other industry sectors.
- There are typically one or more committees and boards that govern and/or advise as to the operations, procurement, and policy surrounding college data processing.
- While computer science plays a role in the structuring of services that the college DP department offers, typically the administrative group of applications are the basis for justifying the expansion and upgrading of facilities.
- A number of colleges have organized a consortium to furnish shared services to its members, usually on a formal, non-profit corporation basis. Other colleges act as a service bureau to nearby schools at the elementary and secondary level, or to county or state owned facilities that cannot justify their own installation.

- Several colleges are tied into the ARPA network but usually not by means of their major computing facility. There may or may not be a link between the main facility and the research (ARPA) facility.
- Budgets for data processing in larger and more independent facilities have a shorter, more direct modification, control, and approval cycle than those facilities that are under county or state control. A frequent complaint from the latter facility is having to wait 3 or more years for the appropriate legislature to approve the expenditure of DP funds which is frequently a typical target for politically motivated cost reduction.
- The impetus for going to DDP appears more than in any other industry sector to be a function of the DP professional staff and management taking the initiative and developing a detailed cost/benefit proposal for approval by the appropriate management and budget committees, and by the legislature if necessary.

(3) Current And Anticipated Application Structures

- Applications in colleges are normally classified either as academic or relating to student instruction and/or research, or administrative, i.e., relating to student registration, recordkeeping, accounting, financial aid, fund raising, etc.
- The most critical applications systems for colleges are registration and financial management in the administrative group, and student problem-solving and programming compilations (near the end of the semester) in the academic group.
- Both administrative and academic systems are candidates for DDP, depending upon whether the college is a self-contained unit or part of a consortium structure.

- In the self-contained unit, the administrative systems may optionally be performed on-line directly to the host.
- Student registration is such a critical high volume application that some colleges routinely commandeer all resources to provide the necessary capacity and redundancy in case of breakdown. Compatibility of hardware and software is essential for this application.
- Applications are almost always developed in-house or by a shared pool of programmers and analysts. Most colleges have also developed or modified internal systems and communications software to meet their needs.
- There is virtually no interest in vendor-provided applications software, except of the utility or educational variety.
- Incompatibilities in network software and control software are seen to be more an irritation than a barrier to DDP in that both the talent and time are available on campus to develop whatever conversion programs are required.
- There is generally little, if any, importance attached to the development costs of software since part of the educational experience is to make, not buy, what is needed.
- Consortium members (considered to be remotes in this context) were somewhat resentful of the necessity to make compromises in their applications specifications to accommodate all other members. Increased remote capacity (larger data files, faster processors) is seen as an opportunity by the remote members to recapture independence in system design and implementation.
- In the same context, there is a heavy appreciation of the necessity for standards in application program development as well as in systems software and hardware. Standards may be enforced by a technical committee as well as by the user organization.

- Security of applications programs and data for administrative systems is a key issue. To the extent possible, security is addressed by keeping administrative systems physically separate from academic systems.
- Few tie-ins to other systems exist or are planned. One college has a tie-in to a numerical control machine for one of its courses. Another mentioned a specific tie-in to the ARPA network but said that the link is rarely used since the research laboratory has its own computer and its own federal funding. A third college occasionally ties-in to other host systems for educational applications that are only available at the other site.
- Generally word processing is not seen as a serious tie-in to DDP, although one college provides a major on-line text editing and letter writing system as part of its DDP service. No estimate is available as to the extent to which office automation will be used in the future or its impact on DDP.

(4) Justification For Adoption Or Non-Adoption Of The DDP Approach

- The primary motivation for colleges to adopt DDP is lowered expected cost followed closely by improved service to the user.
- Cost savings are anticipated in:
 - Communications.
 - Replacement of lower technology equipment with higher technology equipment.
 - Extending the lifetime of the host by off-loading.
 - Economics of specialization.

- Improved service to the user is seen in:
 - Providing the user access to a greater range of resources than available in graphics, mass storage, virtual memory, other languages and specialized applications.
 - Making the user responsible for the integrity of his own programs and data.
 - Increased redundancy providing better assurance of access when part of the system is down.
 - Not having to "re-invent the wheel" for common applications.
 - "A first hand cure for customer ignorance."
- Non-DDP schools cited lack of money in the budget as a reason for not implementing DDP.
- DDP users, on the other hand, expressed concern about:
 - Possible lack of security.
 - Increased complexity to administer billing and chargebacks to users.
 - Greater difficulty in enforcing standards.
 - The need to compromise.
 - Increased necessity for remote managers to use the information that DDP makes readily available in decision-making.
 - The requirement for stronger administration and control and/or a team concept of management.

- The difficulty of pioneering.
- The current absence of true ease of communications, i.e., that DDP is not a transparent function but requires much involvement by the user.

(5) Distributed Data Bases And Communications - Trade-Offs And Trends

- Several techniques for distributing the data base were found in the college sector. All but one installation interviewed has a distributed data base. That site may be considered to be distributed in that it resides at the remote location, although it cannot currently be accessed by the host.
- The most frequently employed technique for distributing a data base is to retain the master set of files at the host and periodically (usually daily) download a subset of the files to the remote location. A transaction log kept at the remote site is polled by the host to update the master files.
- The second technique (which was reported by one installation) employs three functionally dedicated hosts, each with a file that is multiplexed or switchable to either of the other two hosts. Communication is through the file rather than through the host.
- The third technique, used by one installation, retains the functional files at the remote locations but employs a keyed master index at the host which provides the bridge to any of the functional files, using the customer information file concept.
- The portion of the file that is distributed normally relates only to the institution that is using it and may contain locks to prevent unauthorized users from accessing it.
- A formal DBMS was found to be in place at only one host. Equipment limitations and lack of consensus among the users have prevented it from being used by the remotes. A committee is currently studying DBMS applications, capabilities, and standards, and expects to select a DBMS within the year.

- Another installation has developed its own DBMS, which it expects to convert to a new system when the latter is installed.
- Two other installations were insistent that DBMS "makes no sense in a DDP environment," and that at best it would function simply as a file manager.
- The remaining installations currently maintain separate files for each user, and have no definite plans to implement a DBMS. They believed that a DBMS is not cost effective and that a particular DBMS cannot be selected by name in a competitive bid environment.
- Reasons sppcified for distributing the data base involve:
 - Lower costs than current or projected telecommunications costs.
 - Situations that require frequent heavy data access that is not well scheduled, or difficult to schedule in a mixed RJE/interactive environment.
 - A data base structure that becomes too complex if centralized.
- The size of the data base to be distributed to the remote location varies from 4 to 90 megabytes.
- Types of files to be distributed include:
 - Student records.
 - Personnel.
 - Payroll.
 - Adminstrative (financial) information.

- Prospective student application forms and decisions.
- Library circulation records.
- Colleges expressed few concerns or problems with DDP communications, either as to cost or as to reliability.
 - One concern related more to security, involving unauthorized access and theft of computer time by non-students.
 - DDP communications makes positive user identification essential; other security techniques are less valuable or not used.
- Colleges were not happy with incompatible protocols and felt that they restricted access to other educational systems and networks.
 - SNA was described as "using a 747 to go to the city next door when a VW will do;" i.e., it is too complicated and uses too much overhead.
 - DECNET was described as "OK."
- "Network interconnection via software" was rated highly as a necessary feature in vendor selection.
- VAN was not rated highly as a technique for overcoming incompatible protocols.
 - One user mentioned a \$1,200/month charge for a VAN as "too expensive."

(6) Vendor Characteristics For Getting And Keeping DDP Business

- While reliability and maintenance are rated highly as selection criteria in choosing a DDP vendor, price and volume discounts are rated equally highly.

- Since many colleges must follow a public competitive bid policy in DP procurement, they run the risk of getting equipment that is not their first choice and may not even be suitable.
- Threshold values for competitive procurement are usually too low to permit direct selection of a desired vendor. However, special terms and conditions may provide additional competitive advantages, particularly for equipment that must be compatible with an existing installed base.
- College equipment procurements tend to be outright purchases or on a full payout lease, rather than an operating lease.
- In addition to the criteria mentioned above, these factors are also considered important in vendor selection:
 - Network interconnect with software.
 - Vendor image and viability.
 - Language availability.
 - Compatibility of software.
- Not considered important are:
 - Equipment ease of training and use.
 - Availability of all hardware from one vendor.
 - Compatibility of hardware.
 - Availability of applications software from the vendor.

- Companies mentioned favorably as DDP vendors were:
 - Digital Equipment Corporation.
 - Hewlett-Packard.
 - IBM, Data General, and Honeywell.
- Reasons included:
 - Effective price/performance.
 - Suitability for education.
 - Prior proven history in the ARPA network.
 - Processors and software designed to be linked.
 - Broadly recognized name and authority.
- Companies mentioned unfavorably as DDP vendors included:
 - IBM.
 - CDC.
 - DEC, Hewlett-Packard, Data General.
- Reasons for the unfavorable rating include:
 - "Insistence on small systems being tied to a large host presents too costly a solution to DDP."
 - "SNA is ponderous - just overwhelming."

- "Unrealistic attitude that all equipment should be compatible only with the vendor's own product line."

(7) The Future For Remote And Host Participants

- More than in any other industry sector, colleges have structured their DDP in a decentralized fashion.
- Consequently, much latitude exists with the end user to specify his own equipment preference within broad guidelines of compatibility.
- Users are willing to do extensive amounts of software customization to achieve compatibility.
- However, competitive bid procurements will continue to be a common technique and limit the value of direct selling to the end user.
- There will continue to be a heavy emphasis on preserving software compatibility to protect the investment already made.
- Tight budgets that have to be approved by county or state legislatures will continue to be the norm and may delay procurements excessively. The historical easy availability of federal grant funding for educational computing will continue to decrease and will result in some slowdown of DDP implementation, especially for the smaller schools.
- Colleges will continue to depend on large scale host CPU and disk equipment as the most efficient way to provide overflow capacity.
- They will also move to larger minis and greater disk capacity at remote sites in order to maximize independence from the host.
- Within the time frame of this study there will be some experimentation with computing laboratories using microprocessors hooked to minis as sub-hosts. These minis in turn will be linked to a large host mainframe.

- Increasingly sophisticated hierarchical and hybrid networks will be implemented, at least in an experimental fashion.
- Office automation may experience some increased usage in the form of large scale text editing applications although the impact in the college sector will not be felt for several years.

IV FORECAST OF U.S. ALL VENDOR
POTENTIAL AND SHIPMENTS

IV FORECASTS OF U.S. ALL VENDOR POTENTIAL AND SHIPMENTS

A. DETERMINING MARKET POTENTIAL - CLASS I SYSTEMS

- INPUT determined that DDP growth would most dramatically effect the Class I mini and small business computer system market (i.e.: S/32, S/34, Series/1), and to a far less degree impact the larger Class II and III mainframes. Therefore, an analysis for the potential and actual domestic shipment forecast for Class I systems by DDP industry segments was performed.
- INPUT forecasts that the total domestic shipment rate of Class I systems will increase from 70K units in 1977 to 500K units in 1986, an average annual growth rate of 25%. (See Exhibit IV-1.)
 - During this same time period, Class IV systems shipments are forecasted to increase at an annual rate of 15%, and Class II and III systems at a 4% rate.
- Class I systems, with less than 7,000 units entering a DDP environment in 1977, is forecasted to ship 100K-175K units into DDP networks in 1986. A comparison of the other system classes indicates a vast DDP skewing toward the small Class I systems for 1986 with the other Class shipments projected as follows:

EXHIBIT IV-1

TOTAL U.S. SYSTEM SHIPMENTS AND BREAKOUT OF

THOSE SYSTEMS DEDICATED TO DDP

(K UNITS)

SYSTEM CLASS	YEAR													
	1977				1980				1983				1986	
	SHIP- MENTS (SYS- TEMS)	DDP ENVIRONMENT		SHIP- MENTS (SYS- TEMS)	DDP ENVIRONMENT		SHIP- MENTS (SYS- TEMS)	DDP ENVIRONMENT		SHIP- MENTS (SYS- TEMS)	DDP ENVIRONMENT			
		UNITS SYS- TEMS	%		UNITS SYS- TEMS	%		UNITS SYS- TEMS	%		UNITS SYS- TEMS	%		
I	70	< 7	<10	150	15-30	10-20	270	40-70	15-25	500	100-175	20-35		
II	3	<0.3	<10	4.0	<0.4	<10	4-5	<0.5	<10	4-5	<0.5	<10		
III	2	<0.2	<10	2.5	<0.3	<10	2.7	<0.3	<10	3	<0.3	<10		
IV	2.1	0.4-0.6	20-30	3.2	1-1.5	35-50	4.8	2-3	50-60	7.5	5-6	70-80		

- Class II: Less than 500 units of total 1986 shipments to DDP.
- Class III: Less than 300 units of total 1986 shipments to DDP.
- Class IV: 5,000-6,000 units of total 1986 shipment to DDP.
- Forecasts were divided into DDP industry segments and unit volumes per cell as instructed by the client. (See Exhibit IV-2.)
- Enterprise population by industry segment was derived using client source information and is shown in Exhibit IV-3.
- In an effort to provide data in a standard and comparable format, INPUT translated units per industry segment into employees per cell. (See Exhibit IV-4.)
- For example, in Cell 1A which is wholesale enterprises with 20-99 employees (Exhibit IV-2): 11,665 enterprises (Exhibit IV-3) X 60 employees/enterprise $\frac{(20+99)}{2}$ = 700K employees (Exhibit IV-4).
- Conversion factors used to convert all units to employees are as follows:

<u>DDP Segment</u>	<u>Name</u>	<u>Conversion Factor</u>
7	Banks	1 employee/\$1.5M assets
8	School District	1 employee/15 pupil enrollment
9	Hospital	3 employees/bed
10	City/County	1 employee/50 population
11	Motor Freight	1 employee/\$40K revenue
12	Colleges	1 employee/8 pupil enrollment

- Exhibit IV-5 forecasts the number of employees per DDP industry segment cell for the periods 1977, 1980, 1983 and 1986 using a uniform average annual growth rate of 2% for the work force population.

EXHIBIT IV-2

DDP INDUSTRY SEGMENT CATEGORIES AND CELL SIZES (UNITS)

DDP SEG.	POT'L SEGS	NAME	MUE			SUE		GSD-2		UNITS
			A	B	C	D	E	F	G	
1	1-5	WHOLE- SALE	20-99	100-249	250-999			1-9.9K	10K+	EMPLOYEES
2	14-22	RETAIL	20-99	100-249	250-999			1-9.9K	10K+	EMPLOYEES
3	34, 36 w/o 38, 40	PROC. w/o PETR.		100-499	500-999		500-999	1-9.9K	10K+	EMPLOYEES
4	37	PETROL			500-999			1-9.9K	10K+	EMPLOYEES
5	35	AERO/ MOT			500-999			1-9.9K	10K+	EMPLOYEES
6	35	MACH/ FAB			500-999	250-499	500-999	1-9.9K	10K+	EMPLOYEES
7	45, 46	BANKS		50-499	500-999			1-9.9K	10K+	ASSETS (\$M)
8	63	SCHOOL DIST.		10-24.9						ENROLLMENT (K)
9	55	HOSPI- TALS	100-299	300-499	500+					BEDS
10	65-67	CITY/ COUNTY			100-249			250+		POPULATION (K)
11	41	MOT. FRT.			50-99.			100 +		REVENUE (\$M)
12	64	COL- LEGES			5-9.9			10-19.9		ENROLLMENT (K)

EXHIBIT IV-3

ENTERPRISE POPULATION-1977 (UNITS/INDUSTRY SEGMENT)

DDP SEG.	POT'L SEGS	NAME	MUE			SUE		GSD-2			UNITS
			A	B	C	D	E	F	G		
1	1-5	WHOLE- SALE	11,665	1,741	696			247	15		EMPLOYEES
2	14-22	RETAIL	7,394	933	576			258	58		EMPLOYEES
3	34, 36, 38, 40	PROC. w/o PETR.		1,332	949		42	466	101		EMPLOYEES
4	37	PETROL			144			55	25		EMPLOYEES
5	35	AERO/ MOT			67			81	38		EMPLOYEES
6	35	MACH/ FAB			390	541	88	534	84		EMPLOYEES
7	45, 46	BANKS		1,180	233			179	15		ASSETS (\$M)
8	63	SCHOOL DIST.		602							ENROLLMENT(K)
9	55	HOSPI- TALS	2,324	737	614						BEDS
10	65-67	CITY/ COUNTY			304			187			POPULATION(K)
11	41	MOT. FRT.			45			19			REVENUE (\$M)
12	64	COL- LEGES			298			152			ENROLLMENT(K)

EXHIBIT IV-4

NUMBER OF EMPLOYEES PER DDP INDUSTRY SEGMENT CELL-1977 (THOUSANDS)

DDP SEG.	INDUS- TRY NAME	MUE			SUE		GSD-2	
		A	B	C	D	E	F	G
1	WHOLESALE	700	298	438			1,375	180
2	RETAIL	444	158	360			1,419	1,200
3	PROC. w/o PETR.		390	712		32	2,563	4,600
4	PETROL			108			303	880
5	AERO/ MOT			50			446	2,550
6	MACH/ FAB			293	203	66	2,940	5,850
7	BANKS		216	117			656	305
8	SCHOOL DIST.		700					
9	HOSPITALS	1,380	884	1,842				
10	CITY/ COUNTY			1,064			2,244	
11	MOT. FRT.			84			95	
12	COLLEGES			279			285	

- INPUT assumed a figure for the number of employees capable of utilizing an intelligence based system; i.e., a mini or small business computer system for each industry and key year within the study. (See Exhibit IV-6.)
- Consideration was given to the following variables:
 - Wage rate/trends per industry.
 - System price/performance improvements.
 - DDP concept familiarity.
 - Competitive requirements.
 - Type of industry; i.e., manufacturing or service.
- Dividing "Number of Employees per DDP Industry Segment Cell" (Exhibit IV-5) for a specific year by the corresponding "Number of Employees per Minicomputer/SBC (Class I) System" (Exhibit IV-6) yields the "Total U.S. Computer System All Vendor Potential" in units for Class I systems. (See Exhibits IV-8, 9, 10, 11.)
- For example, using the same wholesale industry sector as above:

$$\frac{700\text{K employees (Exhibit IV-5)}}{50 \text{ employees/system (Exhibit IV-6)}} = \frac{14\text{K potential systems}}{\$490\text{M}} \quad (\text{Exhibit IV-8})$$

- Each Class I minicomputer/SBC system is assumed to have an average selling price of \$35,000 for the entire forecast period. Implicit in this assumption is that performance capabilities will continue to improve substantially through the 1977-86 period.

EXHIBIT IV-5

NUMBER OF EMPLOYEES PER DDP INDUSTRY SEGMENT CELL: (1977/1980/1983/1986) (MILLIONS)

DDP SEG.	INDUSTRY NAME	MUE			SUE			GSD-2		
		A	B	C	D	E	F	G		
1	WHOLESALE	.70/.75/ .79/.84	.30/.32/ .34/.36	.44/.47/ .49/.53			1.38/1.46/ 1.55/1.65	.18/.19/ .20/.21		
2	RETAIL	.44/.47/ .50/.53	.16/.17/ .18/.19	.36/.38/ .41/.43			1.42/1.51/ 1.60/1.70	1.20/1.27/ 1.38/1.43		
3	PROC. w/o PETR.		.39/.41/ .44/.47	.71/.75/ .80/.85		.03/.03/ .04/.04	2.56/2.72/ 2.89/3.06	4.60/4.88/ 5.18/5.50		
4	PETROL			.11/.12/ .12/.13			.30/.32/ .34/.36	.88/.94/ .99/1.05		
5	AERO/ MOT			.05/.05/ .06/.07			.45/.48/ .51/.55	2.55/2.70/ 2.86/3.03		
6	MACH/ FAB			.29/.30/ .32/.35	.20/.21/ .22/.23	.07/.07/ .08/.08	2.94/3.12/ 3.20/3.50	5.86/6.22/ 6.60/7.00		
7	BANKS		.22/.23/ .24/.26	.12/.12/ .13/.14			.66/.70/ .74/.79	.31/.33/ .35/.37		
8	SCHOOL DIST.		.70/.74/ .79/.84							
9	HOSPITALS	1.38/1.47/ 1.54/1.65	.88/.94/ 1.00/1.05	1.84/1.96/ 2.08/2.20						
10	CITY/ COUNTY			1.06/1.13/ 1.20/1.27			2.24/2.38/ 2.53/3.02			
11	MOT.FRT.			.08/.09/ .10/.10			.10/.10/ .11/.12			
12	COLLEGES			.28/.30/ .31/.33			.29/.30/ .32/.35			

EXHIBIT IV-6

POTENTIAL: NUMBER OF EMPLOYEES PER MINICOMPUTER/SBC (CLASS I)
(1977/1980/1983/1986)

DDP SEG	NAME	POPULATION/MINICOMPUTER/SBC			
		1977	1980	1983	1988
1	WHOLESALE	50	35	25	20
2	RETAIL	50	40	35	30
3	PROC. (W/O. PET.)	35	30	25	20
4	PETROL	35	30	25	20
5	AERO/MOT	35	30	25	20
6	MACH/FAB	35	30	25	20
7	BANKS	50	40	25	20
8	SCH. DIST.	50	40	35	25
9	HOSPITALS	50	40	35	30
10	CITY/CTY	50	35	30	25
11	MOT. FRT.	35	30	25	20
12	COLLEGES	50	40	35	30

EXHIBIT IV-7

U.S. INDUSTRY FORECAST: MINI/SMALL BUSINESS

(CLASS: I) COMPUTER SYSTEMS ALL

VENDOR SHIPMENTS FORECAST [UNITS (K)]

INDUSTRY	*1977 POPULA- TION (M)	CLASS I SYSTEMS AAGR (%)	1977	1980	1983	1986
WHOLESALE	3.1	34	2	5	12	28
RETAIL	8.1	31	5	10	25	55
MANUFACTURING, PROCESS	10.4	25	17	35	65	125
MANUFACTURING, DISCRETE	11.3	23	22	45	75	140
FINANCE	1.1	38	1	3	7	20
HEALTH	3.3	32	2	5	10	25
EDUCATION	0.9	22	2	3	5	10
TRANSPORTATION	1.8	28	2	4	9	18
GOVERNMENT, LOCAL	3.5	26	<1	2	4	8

*1977 POPULATION IN ESTABLISHMENTS HAVING >20 EMPLOYEES

EXHIBIT IV-8

TOTAL U.S. COMPUTER SYSTEM: ALL VENDOR POTENTIAL AND ACTUAL SHIPMENTS

SYSTEM CLASS: I YEAR: 1977 [UNITS (K)/\$(M)]

DDP SEG.	INDUSTRY NAME	MUE						SUE						GSD-2					
		A		B		C		D		E		F		G					
		POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.
1	WHOLESALE	14/490	0.5/17.5	6/210	0.2/7.0	9/315	0.3/10.5					27/945	1.0/ 35.0	4/140	0.1/3.5				
2	RETAIL	9/315	0.3/10.5	3/105	0.1/3.5	7/245	0.2/7.0					28/980	0.8/ 28.0	24/840	0.7/ 24.5				
3	PROC. w/o PETR.			11/385	0.7/ 24.5	20/700	1.2/ 42.0			1/35	0.05/ 1.8	73/ 2555	4.4/ 154.0	131/ 4585	7.8/ 273.0				
4	PETROL					3/105	0.2/7.0					9/315	0.5/17.5	25/875	1.5/ 52.5				
5	AERO/ MOT					1/35	0.1/3.5					13/455	0.9/31.5	73/ 2555	5.0/175.0				
6	MACH/ FAB					8/280	0.6/21.0	6/210	0.4/ 14.0	2/70	0.1/3.5	84/ 2950	6.0/ 210.0	167/ 5845	11.8/ 413				
7	BANKS			4/140	0.2/7.0	2/75	0.1/3.5					13/455	0.7/24.5	6/210	0.3/10.5				
8	SCHOOL DIST.			14/490	1.4/ 49.0														
9	HOSPITALS	28/980	0.8/28.0	18/630	0.5/17.5	37/ 1295	1.1/ 39.0												
10	CITY/ COUNTY					21/ 735	0.6/ 21.0					45/1575	1.1/ 39.0						
11	MOT.FRT.					2/8	0.1/3.5					3/105	0.1/3.5						
12	COLLEGES					6/210	0.5/17.5					6/210	0.6/21.0						

EXHIBIT IV-9

TOTAL U.S. COMPUTER SYSTEM: ALL VENDOR POTENTIAL AND ACUTUAL SHIPMENTS

SYSTEM CLASS: I YEAR: 1980 [UNITS (K)/\$(M)]

DDP SEG.	INDUSTRY NAME	MUE						SUE						GSD-2					
		A		B		C		D		E		F		G					
		POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.				
1	WHOLESALE	21/730	1.1/38	9/320	0.5/17	13/450	0.7/25							42/1470	2.2/77	5/190	0.3/11		
2	RETAIL	12/420	0.5/18	4/140	0.2/7	10/350	0.4/15							38/1300	1.7/60	32/1120	1.4/50		
3	PROC. w/o PETR.			14/500	1.3/50	25/880	2.4/85			1/35	0.1/4	91/3200	8.8/300	163/ 5700	15.6/ 550				
4	PETROL					4/140	0.4/15					11/390	1.0/35	31/1085	3.0/100				
5	AERO/ MOT					2/70	0.2/7					16/550	1.8/65	90/3200	10.0/ 350				
6	MACH/ FAB					10/350	1.2/ 42	7/250	0.8/30	2/70	0.2/0.7	104/ 3500	12.0/ 420	207/ 7250	23.6/ 830				
7	BANKS			6/210	0.6/21	3/105	0.3/11					18/630	1.7/62	8/300	0.8/30				
8	SCHOOL DIST.			19/670	2.2/80														
9	HOSPITALS	37/1300	1.9/65	24/1850	1.2/40	49/1700	2.6/9												
10	CITY/ COUNTY					32/1100	1.0/35					68/2400	2.2/80						
11	MOT.FRT.					3.0/100	0.2/7					3/100	0.2/7						
12	COLLEGES					8/280	0.9/32					8/280	0.9/32						

TOTAL U.S. COMPUTER SYSTEM: ALL VENDOR POTENTIAL AND ACTUAL SHIPMENTS

SYSTEM CLASS: I YEAR: 1983 [UNITS (K)/\$(M)]

DDP SEG.	INDUSTRY NAME	MUE						SUE						GSD-2					
		A		B		C		D		E		F		G		POT.	SHIP.	POT.	SHIP.
		POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.				
1	WHOLESALE	32/1120	2.7/95	14/500	1.2/42	20/700	1.7/60					62/2200	5.4/190	8/280	0.7/25				
2	RETAIL	14/490	1.1/40	5/180	0.4/14	12/420	0.9/32					48/1700	3.5/1251	39/1370	3.0/105				
3	PROC. w/o PETR.			18/630	2.5/88	32/1120	4.6/160			2/70	0.2/7	116/4100	16.7/580	207/7250	29.9/1050				
4	PETROL					5/175	0.7/25					14/500	2.0/70	40/1400	5.7/200				
5	AERO/ NOT					2/70	0.3/10					20/700	3/105	114/4000	17.3/600				
6	MACH/ FAB					13/450	2.0/70	9/310	1.4/50	3/112	0.4/14	12.8/4500	20.0/700	264/9240	39.8/1400				
7	BANKS			10/350	1.5/53	5/175	0.8/28					30/1050	4.6/160	14/490	2.1/74				
8	SCHOOL DIST.			22/770	3.8/133														
9	HOSPITALS	44.0/ 1540	4.1/145	29/1000	2.7/95	59.0/ 2050	5.5/195												
10	CITY/ COUNTY					40/1400	2.1/75					84/300	4.4/150						
11	NOT.FRT.					4/135	0.4/14					4/140	0.4/14						
12	COLLEGES					9/315	1.6/55					9/320	1.7/60						

EXHIBIT IV-11

TOTAL U.S. COMPUTER SYSTEM: ALL VENDOR POTENTIAL AND ACTUAL SHIPMENTS

SYSTEM CLASS: I YEAR: 1986 [UNITS (K)/\$(M)]

DDP SEG.	INDUSTRY NAME	MUE						SUE						GSD-2					
		A		B		C		D		E		F		G					
		POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.	POT.	SHIP.				
1	WHOLESALE	42/1470	6.3/220	18/630	2.7/95	27/945	3.9/140					83/2900	12.4/ 430	11/390	1.6/56				
2	RETAIL	16/560	2.9/102	6/210	1.0/35	14/490	2.4/84					58/2030	9.4/ 330	47/1645	7.9/280				
3	PROC. w/o PETR.			24/840	5.0/175	43/1500	9.1/320			2.0/70	0.4/14	153/5350	32.8/ 1150	275/ 9625	58.9/ 2050				
4	PETROL					7/245	1.4/50					18/630	3.9/ 140	53/1850	11.3/ 400				
5	AERO/ NOT					4/140	0.6/21					28/980	5.7/ 200	151/ 5280	32.6/ 115				
6	MACH/ FAB					18/630	3.8/135	12/420	2.6/90	4/140	0.8/28	180/ 6300	37.6/ 1320	350/ 12250	74.9/ 2625				
7	BANKS			13/450	3.8/133	7/245	2.1/74					40/1400	11.8/ 415	19/665	5.5/195				
8	SCHOOL DIST.			34/1190	8.8/310														
9	HOSPITALS	55/1925	9.9/350	35/ 1225	6.4/225	73/2555	13.3/ 465												
10	CITY/ COUNTY					51/1800	4.3/150					121/ 4235	9.0/315						
11	NOT.FRT.					5/175	0.8/29					6/210	1.0/35						
12	COLLEGES					11/385	3.0/105					12/420	3.0/105						

B. DETERMINING ALL VENDOR SHIPMENTS - CLASS I SYSTEMS

- INPUT has forecast all Class I system shipments for 1977, 1980, 1983, 1986 (Exhibit IV-7).
- All vendor actual shipments for Class I systems (Exhibits IV-8, 9, 10, 11) were calculated by dividing "Number of Employees per DDP Industry Segment Cell" (Exhibit IV-5) by the number of systems forecasted per 1,000 population by industry and year (Exhibit IV-7).
- For example, again using the smallest wholesale industry sector:

$$\frac{700\text{K employees (Exhibit IV-5)}}{3.1\text{M population (Exhibit IV-7)}} \times 2\text{K systems (Exhibit IV-7)} \\ = 0.5\text{K units (Exhibit IV-8)}$$

C. DETERMINING DDP ALL VENDOR SHIPMENTS - CLASS I SYSTEMS

- The all vendor potential for DDP could equate to the potential of all computer system shipments. This would result in such a low DDP market penetration (when considering all vendor DDP shipments) as to render the potential figure meaningless.
- Therefore, INPUT did not generate DDP potential calculations, but rather emphasized the development of all vendor shipment forecasts for the DDP market.
- INPUT determined that user respondents sampled in this study generally provided little quantitative knowledge regarding their own long term corporate procurement plans. However, an index was developed (see Exhibit IV-12) in order to determine what proportion of all vendor shipments for Class I systems would be placed in a DDP environment.

EXHIBIT IV-12

DDP PROPENSITY INDEX: MINI/SBC

(1977-1980-1983-1986) (1= <10% DDP ENVIRONMENT; 10=90-100% DDP ENVIRONMENT)

DDP SEG.	INDUSTRY NAME	MUE			SUE		GSD-2	
		A	B	C	D	E	F	G
1	WHOLESALE	1-1-2-2	1-1-2-2	1-1-2-2			1-1-2-2	1-2-2-2
2	RETAIL	1-1-2-3	1-2-2-3	1-2-2-3			1-2-3-4	2-2-3-4
3	PROC. w/o PETR.		1-2-2-3	2-2-3-3		2-2-3-3	2-3-3-3	2-3-3-4
4	PETROL			2-2-3-3			2-3-3-3	2-3-3-4
5	AERO/ MOT.			1-2-2-3			2-2-2-3	2-2-3-4
6	MACH/ FAB			1-2-3-3	1-2-2-3	1-2-3-3	2-2-3-3	2-3-3-4
7	BANKS		1-2-2-3	2-2-3-4			2-3-3-3	2-3-4-4
8	SCHOOL DIST.		1-1-2-2					
9	HOSPITALS	1-1-2-2	1-1-2-3	1-2-2-3				
10	CITY/ COUNTY			1-2-2-2			1-2-2-3	
11	MOT. FRT.			1-2-2-2			1-2-2-2	
12	COLLEGES			2-2-2-3			2-3-3-3	

- This index related INPUT's perceived propensity (or inclination) within a specific industry segment to adopt DDP methods. The index was developed by industry, size of enterprise and year of forecast.
- Exhibit IV-13 rates and ranks the interviewers perception of the user's propensity toward embracing the DDP concept by industry and unit size.
- Exhibit IV-14 rates these subjective factors by enterprise size.
- Results reflected on both of these exhibits were combined to develop Exhibit IV-12.
- All vendor DDP shipments for Class I systems (Exhibit IV-15, 16, 17, 18) were calculated by applying the DDP Propensity Index (Exhibit IV-12) against all vendor Class I computer system shipments (Exhibit IV-8, 9, 10, 11).
- Exhibit IV-19 shows how all vendor Class I system DDP shipments increase by industry segment and enterprise for 1977 through 1980, 1983 and 1986.
 - Discrete manufacturing (DDP segments 5 and 6) represents over 40% of all DDP shipments in 1986, although expanding at lower than the industry AAGR of 43% from 1977-1986.
 - The highest DDP AAGRs are for Retail and Hospitals with measurements exceeding 50% during the 1977-1986 timeframe.
- Analysis of Class I system DDP shipments by enterprise size group shows that MUEs in the 20-99 employee range growth sector (but a modest base) increasing at a 48% AAGR from 1977-1986. (See Exhibit IV-20.)
 - All other size groups exhibit an AAGR range from 35-47% AAGR for this same timeframe.

EXHIBIT IV-13

PROPENSITY OF THE USER TO EMBRACE
DDP AS PERCEIVED BY THE INTERVIEWER:
1977, 1980, 1983, 1986
RATING: 1-LOWEST; 10-HIGHEST (RATE/RANK)



DDP SEG	INDUSTRY NAME	1982	1980	1983	1986
1	WHOLESALE	1/12	1/12	1/12	2/12
2	RETAIL	2/7	2/7	3/6	5/5
3	PROCESS w/o PETR.	3/5	3/5	4/3	5/3
4	PETROL	3/4	4/3	4/2	5/2
5	AERO/MOT	2/6	2/6	3/7	4/7
6	MACH./FAB.	3/3	3/4	4/4	5/4
7	BANKS	3/2	3/1	4/1	5/1
8	SCHOOL DISTRICT	2/8	3/8	3/8	4/8
9	HOSPITALS	1/9	1/9	2/10	3/10
10	CITY/CTY	1/10	2/10	2/9	3/9
11	MTR. FRT.	1/11	1/11	2/11	2/11
12	COLLEGES	3/1	3/2	4/5	4/6

EXHIBIT IV-14

RELATIVE PROPENSITY TOWARDS D.D.P.

ADOPTION (5=HIGHEST, 1=LOWEST)

BY ENTERPRISE SIZE AS PERCEIVED BY INPUT

1977:  1986: 
1983:  1980: 

GSD-2:

(G) ● 10K+

(F) ● 1-9.9K

SUE:

(E) ● 500-999

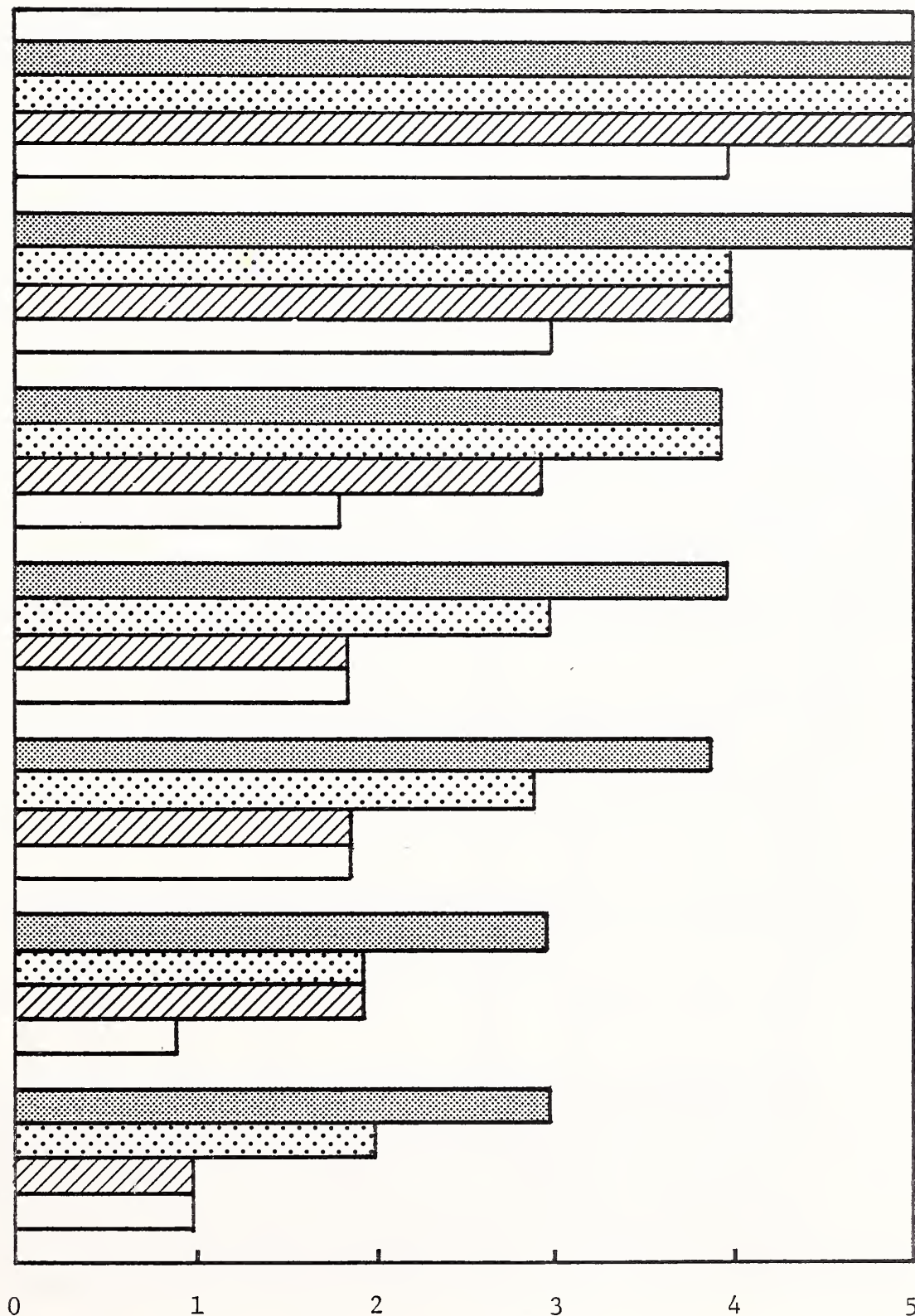
(D) ● 250-499

MUE:

(C) ● 250-999

(B) ● 100-249

(A) ● 20-99



RELATIVE PROPENSITY

EXHIBIT IV-15

ALL VENDOR DDP SHIPMENTS [UNITS (K)] SYSTEM CLASS: I YEAR: 1977

DDP SEG.	INDUSTRY NAME	MUE			SUE		GSD-2		
		A	B	C	D	E	F	G	
1	WHOLESALE	.03	.01	.01			.05	.01	
2	RETAIL	.02	.01	.01			.04	.04	
3	PROC. w/o PETR.		.04	.18		.01	.70	1.20	
4	PETROL			.03			.08	.23	
5	AERO/ MOT			.01			.05	.30	
6	MACH/ FAB			.03	.02	.01	.30	.60	
7	BANKS		.01	.02			.10	.05	
8	SCHOOL DIST.		.07						
9	HOSPITALS	.04	.02	.05					
10	CITY/ COUNTY			.03			.05		
11	MOT. FRT.			.01			.01		
12	COLLEGES			.07			.09		

EXHIBIT IV-16

ALL VENDOR DDP SHIPMENTS [UNITS (K)] SYSTEM CLASS: I YEAR: 1980

DDP SEG.	INDUSTRY NAME	MUE			SUE			GSD-2		
		A	B	C	D	E	F	G		
1	WHOLESALE	.05	.03	.04			.11	.04		
2	RETAIL	.03	.03	.06			.25	.21		
3	PROC. w/o PETR.		.20	.36		.01	2.20	4.00		
4	PETROL			.06			.25	.75		
5	AERO/ MOT			.03			.27	1.50		
6	MACH/ FAB			.18	.12	.03	1.80	6.00		
7	BANKS		.09	.04			.40	.20		
8	SCHOOL DIST.		.11							
9	HOSPITALS	.10	.06	.39						
10	CITY/ COUNTY			.15			.33			
11	MOT. FRT.			.03			.03			
12	COLLEGES			.13			.23			

EXHIBIT IV-17

ALL VENDOR DDP SHIPMENTS [UNITS (K)] SYSTEM CLASS: I YEAR: 1983

DDP SEG.	INDUSTRY NAME	MUE			SUE		GSD-2	
		A	B	C	D	E	F	G
1	WHOLESALE	.40	.18	.25			.81	.11
2	RETAIL	.16	.06	.13			.90	.75
3	PROC. w/o PETR.		.37	1.20		.05	4.20	7.50
4	PETROL			.20			.50	1.42
5	AERO/ MOT			.05			.45	4.32
6	MACH/ FAB			.50	.21	.10	5.00	10.00
7	BANKS		.22	.20			1.15	.70
8	SCHOOL DIST.		.57					
9	HOSPITALS	.60	.40	.82				
10	CITY/ COUNTY			.32			.66	
11	MOT. FRT.			.06			.06	
12	COLLEGES			.24			.43	

EXHIBIT IV-18

ALL VENDOR DDP SHIPMENTS [UNITS (K)] SYSTEM CLASS: I YEAR: 1986

DDP SEG.	INDUSTRY NAME	MUE			SUE		GSD-2	
		A	B	C	D	E	F	G
1	WHOLESALE	.84	.40	.60			1.82	.24
2	RETAIL	.75	.25	.60			3.20	2.77
3	PROC. w/o PETR.		1.25	2.30		.10	8.20	20.62
4	PETROL			.35			1.10	3.96
5	AERO/ MOT			.15			1.40	11.41
6	MACH/ FAB			.95	.65	.20	9.40	26.22
7	BANKS		.10	.70			2.95	1.93
8	SCHOOL DIST.		1.24					
9	HOSPITALS	1.50	1.60	3.30				
10	CITY/ COUNTY			.61			2.25	
11	MOT. FRT.			.12			.15	
12	COLLEGES			.75			.75	

EXHIBIT IV-19

ALL VENDOR CLASS I SYSTEM POTENTIAL (AVP), SHIPMENTS (AVS) AND
DDP SHIPMENTS (AVDDP) BY DDP INDUSTRY SEGMENT GROUPINGS; 1977, 1980, 1983, 1986

(K UNITS)

DDP SEG	INDUSTRY	1977			1980			1983			1986			1977-1986 DDP AAGR
		AVP	AVS	AVDDP	AVP	AVS	AVDDP	AVP	AVS	AVDDP	AVP	AVS	AVDDP	
1	WHOL	60	2.1	0.11	90	4.8	0.27	136	11.7	1.75	181	26.9	3.90	49%
2	RET	71	2.1	0.12	96	4.2	0.58	118	8.9	2.00	141	23.6	7.57	58
3	PROC	236	14.2	2.13	294	28.2	6.77	375	53.9	13.32	497	106.2	32.47	35
4	PETROL	37	2.2	0.34	46	4.4	1.06	59	8.4	2.12	78	16.6	5.41	36
5	AERO/MOT	87	6.0	0.36	108	12.0	1.80	136	20.6	4.82	183	38.9	12.96	49
6	MACH/FAB	267	18.9	0.96	330	37.8	8.13	417	63.6	15.81	564	119.7	37.42	50
7	BANKS	25	1.3	0.18	35	3.4	0.73	59	9.0	2.27	79	23.2	5.68	47
8	SCHOOL	14	1.4	0.07	19	2.2	0.11	22	3.8	0.57	34	8.8	1.24	38
9	HOSPITALS	83	2.4	0.11	110	5.7	0.55	132	12.3	1.82	163	29.6	6.40	57
10	CITY/CTY	66	1.7	0.08	100	3.2	0.48	124	6.5	0.48	172	13.3	2.86	49
11	MOT. FRT.	5	0.2	0.02	6	0.4	0.06	8	0.8	0.12	11	1.8	0.27	34
12	COLLEGES	12	1.1	0.16	16	1.8	0.36	18	3.3	0.67	23	6.0	1.58	28
	TOTAL	963	53.6	4.64	1,240	108.1	20.84	1,604	202.8	46.25	2,126	414.6	117.68	43%

EXHIBIT IV-20

ALL VENDOR CLASS I SYSTEM POTENTIAL (AVP) SHIPMENTS (AVS) AND DDP SHIPMENTS (AVDDP)

BY ENTERPRISE SIZE GROUPING: 1977, 1980, 1983, 1986

(K UNITS)

ENTER GROUP	* SIZE	1977			1980			1983			1986			1977-1986 DDP AAGR
		AVP	AVS	AVDDP	AVP	AVS	AVDDP	AVP	AVS	AVDDP	AVP	AVS	AVDDP	
MUE	A	51	1.6	.09	70	3.5	0.18	90	7.9	1.16	113	19.1	3.09	48%
MUE	B	56	3.1	.16	76	6.0	0.52	98	12.1	1.80	130	27.7	4.84	46
MUE	C	116	5.0	.45	159	10.5	1.47	201	20.6	3.97	260	44.7	10.43	42
SUE	D	6	0.4	.02	7	0.8	0.12	9	1.4	0.21	12	2.6	0.65	47
SUE	E	3	0.2	.02	3	0.3	0.04	5	0.6	0.15	6	1.2	0.30	35
GSD2	F	301	16.1	1.47	399	32.5	5.77	515	61.7	14.16	699	126.6	31.22	40
GSD2	G	430	27.2	2.43	526	54.5	12.70	686	98.5	24.80	906	192.7	67.15	45
TOTAL		963	53.6	4.64	1,240	108.1	20.80	1,604	202.8	46.25	2,126	414.6	117.68	43%

*SEE EXHIBIT IV-2

D. DETERMINING ALL VENDOR SHIPMENTS - CLASS II/III/IV SYSTEMS

- INPUT forecasts that during the 1977-1986 time period, the value of all U.S. shipments for all system classifications (I, II, III, IV) will increase at an average annual rate of about 15%.
- The increased price/performance and flexibility offered by the Class I systems (mini and small business systems) will impact the Class II and III systems, which INPUT believes will continue to operate primarily in a non-DDP environment.
 - Minicomputer (Class I) systems will become more modular in construction and offer increasingly greater flexibility than the traditional Class II and III systems.
- Concurrently, large Class IV systems shipments will act as DDP hosts at an increasing rate through the forecast period.
- Exhibit IV-21 shows the continued 20-25% AAGR (1977-1986) of Class I system shipments, with the large Class IV systems being shipped at a somewhat slower growth rate (about 15% annually).
- The 3 to 1 ratio of the percentage of Class IV versus Class I system shipments entering a DDP environment is expected to remain constant throughout the forecast period despite dramatic Class I system shipment growth.
- INPUT believes this will be the case because:
 - Freestanding small business computers will continue to proliferate amongst first time computer users or those defecting from service bureaus.

EXHIBIT IV-21

ALL U.S. SYSTEM SHIPMENTS AND PERCENTAGE

IN DDP ENVIRONMENT: 1977, 1980, 1983, 1986

SYSTEM	1977		1980		1983		1986		AAGR 77-86
	SHIPS	% DDP	SHIPS	% DDP	SHIPS	% DDP	SHIPS	% DDP	
CLASS I	\$ 2.5B	<10%	\$ 5.0B	10-20	\$ 9.5B	15-25	\$17.0B	20-35	23%
CLASS II & III	2.2	<10%	2.5	<10%	2.7	<10%	3.0	<10%	4
CLASS IV	5.3	20-30	8.0	35-50	12.0	50-60	18.5	70-80	15
TOTAL	\$10.0B	-	\$15.5B	-	\$24.2	-	\$38.5	-	16%

- The large system, acting as a DDP host, will be the means by which corporate centralized control is maintained.
- Exhibit IV-22 shows how, from 1977 to 1986, the distribution of the user's EDP budgets for hardware purchases are forecasted to double for mini/small business computers versus a decrease of about 15% for the larger processors and mainframes.
- Exhibit IV-23 describes price/performance improvements forecasted for each system classification. The larger the system size, the greater is the percentage use of electronic devices, which in turn offers more cost reduction opportunities. Forecasts for system price/performance gains for the 1977-1986 time period, resulting from anticipated product cost reductions are:
 - Class I Systems: 3.5:1
 - Class II and III Systems: 5.2:1
 - Class IV Systems: 7.5:1

EXHIBIT IV-22

PROJECTED PERCENTAGE HARDWARE BUDGET DISTRIBUTIONS

HARDWARE OR SYSTEM	1977	1980	1983	1986
• PROCESSORS AND MAIN-MEMORY (CLASS II, III, IV)	30%	27%	25%	25%
• PERIPHERALS	25	25	25	25
• MINI/SMALL BUSINESS COMPUTER SYSTEMS (CLASS I)	10	15	18	20
• TERMINALS AND DATA COMMUNICATIONS	35	33	32	30
TOTAL	100%	100%	100%	100%

EXHIBIT IV-23

PRICE/PERFORMANCE IMPROVEMENT
FORECAST

SYSTEM CLASS	1977	1980	1983	1986	AVERAGE ANNUAL IMPROVEMENT
I	1.0	1.5	2.3	3.5	15%
II	1.0	1.7	3.0	5.2	20
III	1.0	1.7	3.0	5.2	20
IV	1.0	2.0	3.8	7.5	25

